73 Amateur Radio Today

AUGUST 1995
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International Edition

VE7PMR's "SOLAR" LANDER

Packet Radio Intro
19,200-Baud Packet
Packets & Palmtops
Packets From Space
Tube-Type TNC

73 Reviews:
HP-200LX Palmtop
ICOM Z1A Dual-Band HT
Standard C508A Dual-Band HT

Construction:
Single-Chip IDer
The O
Precis
Stand

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#0000191981#MR JUN76 349 45
UNIV MICROFILM
SERIAL PRCNG ATTNL P
300 N ZEEB RD
ANN ARBOR MI 48103-1553

ICOM HANDHELD TRANSCEIVERS

IC-V68

- For Export Only
- 136-174 MHz Tx/Rx
- 5 W @ 13.8 V DC
- 40 Memory Channels
- AA Battery Case (BP-99) standard. NiCd version also available (BP-160+BP-99)
- ANI (Automatic # ID)
- Cloning (via cable)
- Code Squelch/Paging
- Programming Manual Required
- PL Tone (88.5 hz) Built-in (38 others with the UT-86)
- PC Programmable
- Voice Scrambler (UT-88 Required)
- Fully Programmable

IC-U68

- Same features as V68
- 440 MHz

IC-2GXA

- For Export Only - Not Certified for U.S. Use
- 2 M
- 7 W @ 13.5 V DC
- 40 Memory Channels
- AA Battery Case (BP-130A) standard. NiCd version also available (BP-130A+BP-160)
- Wall charger incl. w/both models.
- No Touch Tone Pad
- C.T.C.S.S.
- Built-in PL Encode/Decode
- Auto Repeater Operation
- Tone Scan (UT-86)
- Channel Only Mode

IC-2GXAT

- 2 M
- 7 W @ 13.5 V DC
- 40 Memory Channels
- 700 mAh Battery
- Auto Repeater Operation
- Tone Scan
- DTMF Redial, Memories
- 350 mW Audio
- Selectable DTMF Speed
- Built-in PL Encode/Decode
- 35 mA Current Drain

IC-4GXAT

- Same features as 2GXAT
- 440 MHz

IC-2GXAT-HP

- 2 M
- 7 W @ 13.5 V DC
- BP-174 Battery Pack (12 V, 600 mAh)
- AD-25 Battery Charge Adapter Incl.
- 40 Memory Channels
- 700 mAh Battery
- Auto Repeater Operation
- Tone Scan
- DTMF Redial, Memories
- 350 mW Audio
- Selectable DTMF Speed
- Built-in PL Encode/Decode
- 35 mA Current Drain

IC-T22A

- 2 M, 5 W @ 13.5 V
- 4.0 - 16 V DC Input (Charges Batt. During Op.)
- Auto Low Power/ Power Saver (15 mA Drain)
- Remote Control Mic (Opt. HM-75A)
- 40 Memory Channels w/Alpha Display
- Air Cloning
- VHF/UHF Air Band Rx
- Auto Repeater Func.
- Backlit Display
- Channel-only Display if Desired
- Die Cast Frame and Heat Sink
- Tone Scan (Opt. UT-84)

IC-T42A

- Same features as T42A
- 440 MHz

IC-T21A

- 2 M
- 6 W @ 13.5 V DC
- Bonus Receive Band (2 M or 440 MHz)
- 6 Hours Operating Time
- 114 Memory Channels
- 33 Channels/Sec Scan
- Auto Low Power
- Full Crossband Duplex
- Battery Capacity Indicator
- Selectable DTMF Speed
- Auto Repeater Shift
- Tone Scan Built-in
- Backlit Keyboard

IC-T41A

- Same features as T21A
- 440 MHz

IC-V21AT

- 2 M/220 MHz
- 5 W @ 13.8 V DC
- Rx Two Signals on Same Band
- Built-in Pocket Beep, Pager
- Built-in Code, Tone Squelch
- Repeater Quick Memory
- Backlit Keypad
- Auto Output Power Control
- 900 mAh Battery
- 70 Memories
- Whisper Mode (opt)

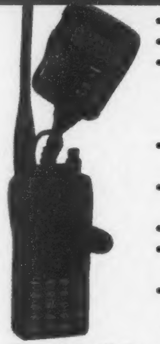
IC-X21AT

- 440 MHz/1.2 GHz
- Bonus 2 M Receive
- 5 W (440 MHz), 1 W (1.2 GHz)
- 70 Memories
- Built-in Pager, Code Squelch
- Built-in Pocket Beep, Tone Squelch
- Repeater Quick Memory
- Auto Power Output
- Whisper Mode (opt)
- 900 mAh Battery
- 5 Power Levels
- Backlit Keypad

IC-W31A

- 2 M/440 MHz
- 5 W @ 13.5 V
- Remote Control Speaker Mic (Opt. HM-75A)
- 100 Memories with Alphanumeric Display
- Alphanumeric Message and Paging
- Backlit Display & Keypad
- Independent Tuning Knobs
- Long Operating Times (Power Saver and 700 mAh Battery)
- V/V, V/U, U/U Operation (Simultaneous Receive)
- External DC (4.0 V - 16.0 V) Charges Battery During Operation
- Auto Repeater Functions
- CTCSS Encode Stnd. (Decode Opt. UT-93)
- Tone Scan (Opt. UT-93)
- AM Aircraft RX

IC-Z1A



- 2 M/440 MHz
- 5 W @ 13.5 V
- Detachable Remote Control Speaker/Mic Standard with Full Functional Control and Dual Band Display
- 100 Memories with Alphanumeric Display
- Alphanumeric Message and Paging
- Backlit Display and Keypad
- Independent Tuning Knobs
- Long Operating Times (Power Saver and 700 mAh Battery)
- V/V, V/U, U/U Operation (Simultaneous Receive)
- Tone Scan (Opt. UT-93)
- AM Aircraft Rx
- External DC (4.0 V - 16.0 V)

Charges Battery During Operation

- Auto Repeater Functions
- CTCSS Encode Stnd. (Decode Opt. UT-93)

IC-△1A

- 2 M/440 MHz/1.2 GHz
- 5 W (2 M), 5 W (440 MHz), 1 W (1.2 GHz)
- 3 Independent Bands
- Simultaneous Receive
- 3 Independent Displays
- Crossband Double Duplex
- Programmable Digital Squelch
- Speaker Selection
- 78 Memories
- DTMF Encode/Decode
- PL Encode
- Clock
- 1200 mAh Battery

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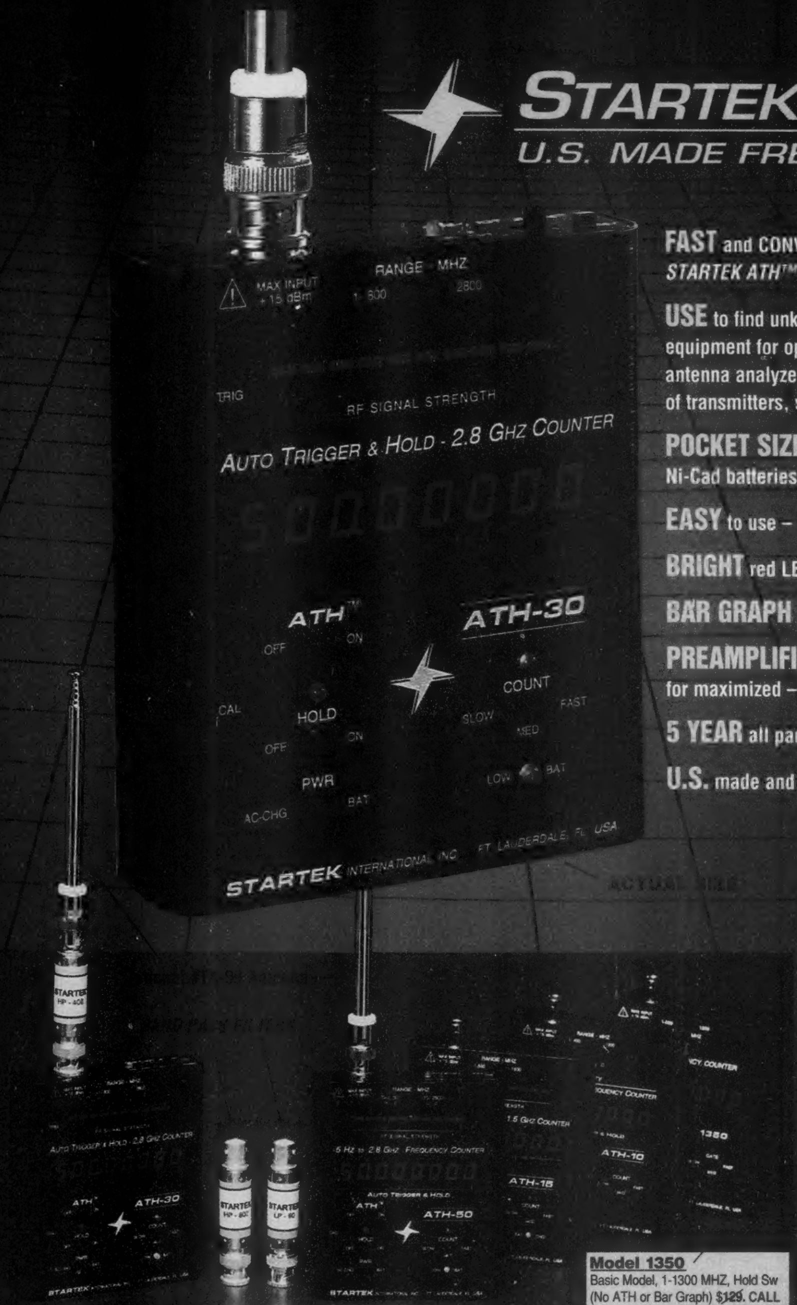
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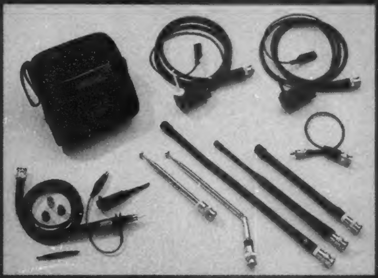

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#TA-90-L	Telescope Elbow BNC Antenna	16
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#RD-2750	27 & 50 MHZ Rubber Duck Antenna	19
#RD-450	450 MHZ Rubber Duck Antenna	16
#RD-800	Cellular phone band RD Antenna	16
#P-110	200 MHZ 1X-10X Probe	39
#LP-22	Low Pass, Audio Probe	25
#DC-10	Direct, 50 OHM Probe	20
#DC-5	BNC Cable to Clip Leads	12
#M-207-IC	Interface Cable MFJ Ant. Analyzers	10
#APA-9	9VDC Auto Power Adapter	6

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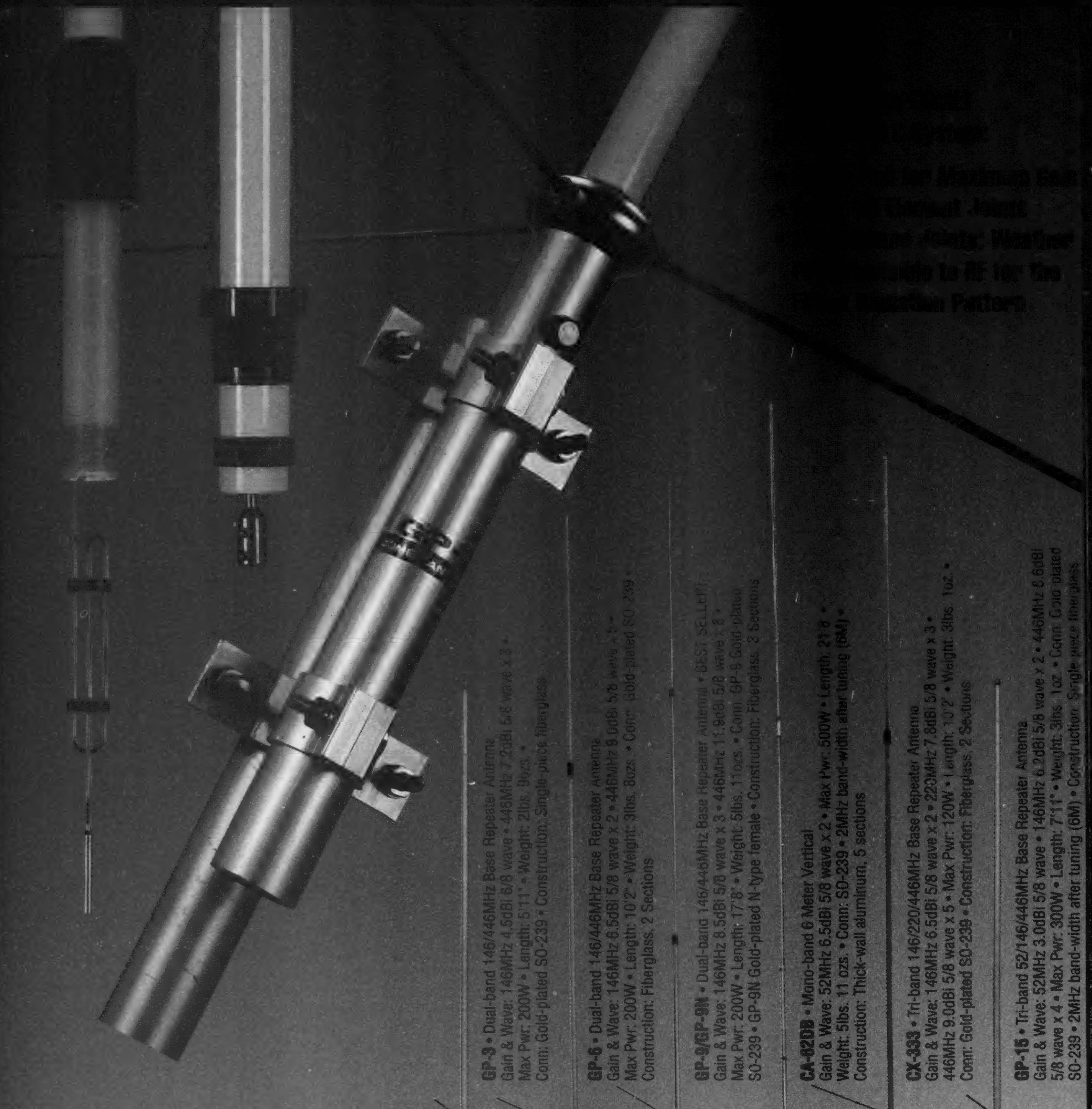

GP-3 • Dual-band 146/446MHz Base Repeater Antenna
Gain & Wave: 146MHz 4.5dBi 6/8 wave • 446MHz 7.2dBi 5/8 wave x 3 •
Max Pwr: 200W • Length: 5'11" • Weight: 2lbs. 9ozs. •
Conn: Gold-plated SO-239 • Construction: Single-piece fiberglass

GP-6 • Dual-band 146/446MHz Base Repeater Antenna
Gain & Wave: 146MHz 6.5dBi 5/8 wave x 2 • 446MHz 9.0dBi 5/8 wave x 5 •
Max Pwr: 200W • Length: 10'2" • Weight: 3lbs. 8ozs. • Conn: Gold-plated SO-239 •
Construction: Fiberglass, 2 Sections

GP-9/GP-9N • Dual-band 146/446MHz Base Repeater Antenna • BEST SELLER!
Gain & Wave: 146MHz 8.5dBi 5/8 wave x 3 • 446MHz 11.9dBi 5/8 wave x 8 •
Max Pwr: 200W • Length: 17'8" • Weight: 5lbs. 11ozs. • Conn: GP-9 Gold-plated
SO-239 • GP-9N Gold-plated N-type female • Construction: Fiberglass, 3 Sections

CA-62DB • Mono-band 6 Meter Vertical
Gain & Wave: 52MHz 6.5dBi 5/8 wave x 2 • Max Pwr: 500W • Length: 21'8" •
Weight: 5lbs. 11 ozs. • Conn: SO-239 • 2MHz band-width after tuning (6M) •
Construction: Thick-wall aluminum, 5 sections

CX-333 • Tri-band 146/220/446MHz Base Repeater Antenna
Gain & Wave: 146MHz 6.5dBi 5/8 wave x 2 • 220MHz 7.8dBi 5/8 wave x 3 •
446MHz 9.0dBi 5/8 wave x 5 • Max Pwr: 120W • Length: 10'2" • Weight: 3lbs. 1oz. •
Conn: Gold-plated SO-239 • Construction: Fiberglass, 2 Sections

GP-15 • Tri-band 52/146/446MHz Base Repeater Antenna
Gain & Wave: 52MHz 3.0dBi 5/8 wave • 146MHz 6.2dBi 5/8 wave x 2 • 446MHz 8.6dBi
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SO-239 • 2MHz band-width after tuning (6M) • Construction: Single-piece fiberglass

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73 Amateur Radio Today

August 1995
Issue #419

TABLE OF CONTENTS

FEATURES

10 **Tube TNC**
A packet breakthrough! W0XI

12 **VE7PMR Solar-Powered Packet Node**
Is packet worth nearly freezing on a mountain? Sure! VE7VMS

16 **19,200-Baud Packet**
A simple way to do it. WB9JTK

24 **RF Speech Processing**
How to get an extra 6 to 9 dB of talk power on SSB. VK3CA

26 **Working the Final Frontier**
Ideas for a fun and easy ham space program. N2CQR/H18

30 **Single-Chip Identifier**
A simple, compact identifier for foxhunting and beacon operation. K4CHE

32 **Radios, Telephones, and the Amateur**
Who's the culprit in telephone interference: the RF station or the telephone? W5UOJ

44 A Simple Precision Voltage Standard
A tool for the serious builder's workbench. K4GOK

48 **Transformerless Amplifier**
Putting an old twist on new technology. W6YBT

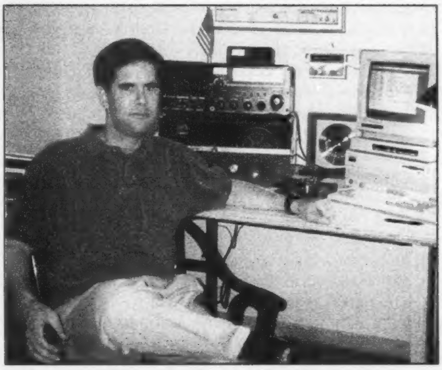
55 **The Octopus**
A simple multipurpose testing device. KB5RMZ

REVIEWS

34 **Icom Z1A Dual-Band HT**
It's definitely different! WB6NOA

40 **Hewlett Packard 200LX Palmtop Computer**
What, another computer? Try this one on for size. KE8WO

42 **Teeny Talkie!**
Standard redefines



Why does this man look so content? Because he's working manned and unmanned satellites with relative ease and rather ordinary gear. You can, too! See page 26.

DEPARTMENTS

62 **Above and Beyond**
73 **Ad Index**
56 **Ask Kaboom**
82 **Barter 'n' Buy**
58 **Carr's Corner**
17 **Feedback Index**
60 **Hams with Class**
64 **Hamsats**
68 **Homing In**
67 **Packet & Computers**
6 **Letters**
4 **Never Say Die**
70 **New Products**
82 **Propagation**
66 **QRP**
8 **QRX**
59 **RTTY Loop**
79 **Special Events**
86 **Uncle Wayne's Bookshelf**

FEEDBACK... FEEDBACK!

It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK list on page 17. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best.

On the cover: Borrowing ideas from NASA, and devising some of their own, VE7PMR and friends engineered and installed a solar-powered packet node that's survived some extremely harsh conditions. Read about their adventure, beginning on page 12.

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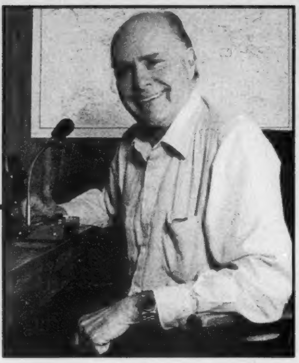
Contract: Castin' yer glazzies on this piece o' prose has just drawn you into a legal obligation to involve youngsters in your ham activities. F'rinstance, invite a kid to help install a new antenna. Explain and teach as you work, and then take him/her into the shack to hear the results while munching on something tasty. (Food's the key—my elmer hooked me with barbecued ribs!)—Nuge WB8GLQ

Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1



Colorado Springs In July

If it isn't too late, maybe you can make it to the Tesla Society conference, July 20-23, where I'll be giving a talk on the latest developments in cold fusion. There will be a bunch of hams there; so make it if you can. They always have some great speakers and you are bound to find yourself getting interested in something new and exciting. How about a 10-pound, 10-horsepower motor? That new way to destroy radioactivity I've written about? Biomagnetics? There will be papers on free energy research, transmutation, health hazards, and advanced technology. Call 719-475-0918 and tell 'em Wayne sent you. The four-day conference is only $250. Heck, the recent cold fusion conference cost almost three times that. And wait'll you see some of the books they have for sale! I came back last time with a suitcase full.

If you're into ragtime music (which you should be), you can follow me to nearby Boulder every evening for the ragtime festival, which is on the same weekend. Scott Kirby, my recording star, will be performing. You really don't want to miss him.

Now don't tell me you can't afford the airfare. Tsk. Just get a Continental Airlines credit card and get your free flier miles the way Sherry and I do. We flew first class to London and back from Paris for the cold fusion conference, all on flier miles. And she's taking a couple of her granddaughters to Hong Kong this summer the same way.

If you'd been reading my travels booklets (see Uncle Wayne's Bookshelf), you'd know all about these things. That NSD also stands for Never Squander a Dollar.

Virginia Beach

Okay, if you miss my Colorado Springs talk, you've got one more chance to hear Uncle Wayne live. I'll be talking this year again at the Virginia Beach (VA) hamfest on July 23. That's not far from Washington DC. What better way to save the $5 I charge for my talk on tape? And I know from last year that they throw one heck of a good hamfest; so make the trip and say hello in person. Ask for a QSL card. And don't put it off until next year. A good friend of mine who was 20 years younger just dropped dead of a heart attack, so I could go pffft at any time.

Like most hamfests these days, the flea market is loaded with computer stuff, if you know any hackers, get 'em there. The flea market is indoors, so even if they come up with Dayton-type weather, you'll keep dry. I'd say a good half of the exhibitors were computer oriented last year.

I also had a fabulous time at the nearby Edgar Cayce Foundation book store. That's where I found some of the more interesting books I've been reviewing. I'll be there again, credit card in hand.

Set aside July 23-24. For details, if you need 'em, you can call 804-486-3800. But don't try climbing the White House fence until after the hamfest.

History Repeating

A chap asked me how come, if cold fusion is so good, that the media haven't picked up on it. I explained that this is normal. I've been through this before, so I'm not surprised or even particularly frustrated.

When the first microcomputer was announced in January 1975 I immediately saw the potential (and wrote about it in my editorials in *73*). I started looking around for someone with computer smarts to hire as an editor for a microcomputer magazine. I called and wrote to the editors of every computer hobbyist newsletter I could find, asking if they were interested. It wasn't until May that I found one and we got started immediately, with the first issue of *Byte* coming out in August. From day one until the issue was on the presses, it took us only six weeks to generate subscribers and articles. Well, I drew heavily on *73* authors of computer articles. The magazine was done entirely by my *73* staff, other than the editor, including the ad sales.

I wrote the subscription letters and mailed them to every name I could get from people selling computer accessories and to the members of computer clubs. I wrote and sent ad sales letters to potential advertisers. I called my *73* authors for articles. It was a hectic six weeks.

Then, when the first issue came out, I took it personally to visit the major potential advertisers such as MITS in Albuquerque, Sphere in Salt Lake, and South West Tech Products in San Antonio. I stopped off and showed it to my friend Ed Juge in Ft. Worth and got him hooked. He later sold his ham store and became a bigwig at Radio Shack as a result.

But the mainframe and minicomputer crowd weren't impressed by microcomputers, which they termed "toys." They were led astray by the main computer publication, *Computerworld*, which spared no opportunity to make fun of micros and ridicule them. I wonder if there is the basis for a class-action suit against that publication for leading the industry astray. I personally hold *Computerworld* mostly responsible for the disaster which eventually hit Wang, Data General, DEC, Prime, Centronics, and a hundred other smaller companies.

By the time the minicomputer companies finally discovered the power of the microcomputers, it was too late for them to cope with the change. Tens of thousands have been thrown out of work as a result.

So here we are with history repeating itself. This time it's the fossil fuel and power companies which are going to go the way of mainframes and DEC minicomputers. Can Texaco, Exxon, BP, Shell, Citgo, and so on, really go the way of RCA and Honeywell mainframes?

Just as these days I'm sending letters and faxes about what's going on with cold fusion to Rush Limbaugh, Paul Harvey, CNN, AP, *The New York Times, The Washington Post, Time, Newsweek, Dateline NBC, 60 Minutes,* and so on, twenty years ago I was doing the same to the major news media of the day, trying to alert them to the importance of the microcomputer. The results are the same: zero.

I suppose it was the same with the harness-makers and buggy-whip manufacturers when the automobile came on the scene. Are any of the old slide rule companies making electronic calculators? No. How many of the old watch companies are still around? Very few. All those companies failed because they didn't see changes coming. And changes can be upon us before we know it, unless we do our homework.

Look at the millions of people who've been put out of work by automation or the moving of their jobs to lower-wage countries. Sure, if they'd been doing their homework, they'd have seen it coming and taken the time to develop new skills. Instead, they worked at the same job for years and spent their spare time having fun. Then, when the ax fell, they were astounded, confused, and angry. It sure wasn't their fault. Blame the company. Blame the government. But don't blame yourself.

Speaking of which, how secure is *your* job? Communications and computer technology changes have eliminated many middle management jobs, and will be eliminating more. Automation and cheaper foreign workers will be putting more blue-collar workers out of work unless they develop new and more needed skills. This is one reason why I've been preaching entrepreneurialism for so many years. When you own the company, you may pay more attention to the future so as not to be taken by surprise by new technologies. Or not.

CD-ROM legal libraries are putting thousands of young lawyers out of work as law firms computerize their law libraries. It wasn't that long ago that insurance companies had hundreds of statisticians with Monroe or Friedan calculators on their desks. Monroe? I remember when, far too late in the game, Monroe tried to change to computers. I've got an old Monroe calculator out in the barn somewhere. It was a $1,000 item at one time and a real marvel. I even mounted it in my Porsche Speedster for rallies and had a winning streak as a result.

Then along came the Curta calculator, which did the same job, only was the size of a pepper grinder. It was made in Liechtenstein for use as currency converters for European banks. So I went to the factory, talked to the prince who ran the country and the factory, and arranged to import 'em for rally use. I sold a ton of 'em. Of course, I was into car rallies at the time.

These days the same job can be done by a small electronic calculator.

Rallyists also needed very accurate watches. To win a rally, you often had to average less than a half-second error per checkpoint over a dozen or two checkpoints. A watch that was off by a half second in six hours could lose a rally for you. So I went to Schwenningen, in Germany, and had the Hanhart company make a special 17-jewel, 1/100-minute stopwatch for me to sell through my Radio Bookshop, along with the Curta calculators and other rally paraphernalia. I made enough money selling rally equipment by mail order to buy a second Porsche. I also converted and sold push-button surplus radios just tuned to bring in CHU and WWV for checkpoint timing use. What's the point of my arriving at a checkpoint exactly on time if their watch is off by a half second? And that happened to me every now and then. It was frustrating to lose because my watch was more accurate than their's.

Rallies are great fun. You must have an expert driver who can keep exactly on time, no matter what. And you need

Continued on page 74

DUAL PORT

DUAL SPEED

The KPC-9612 offers more performance than any other TNC in its price range. It's the only 9600 baud unit with simultaneous dual-port operation, so it can send and receive messages at both 1200 and 9600 baud (or even 19K2). Kantronics also offers an optional K-Net EPROM and, unlike any other TNC, the KPC-9612 can operate as both a TNC and a node at the same time. K-Net is NETROM™ compatible and includes remote access so all commands are available from a remote location.

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Number 2 on your Feedback card

LETTERS

From the Ham Shack

Jeff Bussard N3EVN, Moon Twp. PA I just watched a presentation on C-Span concerning the "deauthorizing" (their words) of the FCC. It seems that a conservative "think tank," with support of House Speaker Newt Gingrich, is proposing that the FCC be reduced to an executive department reporting to the president. The "new" FCC will simply be engaged in brokering spectrum on behalf of our government. How much spectrum one purchases and what one does with it will not be within the FCC's jurisdiction. No more regulations on content, mode, or who will operate within it. Let the free market determine what use is best. It's all for sale! Individuals, companies, partnerships, etc., are all invited.

The concept, which seems valid, goes like this . . . All spectrum is an asset, just like land. It can be occupied and utilized by the owner. If that owner wishes to lease it, or directly use it for broadcasting, cell-phones, data, etc., he can. Or, he can speculate and sell it for a profit or loss. The FCC would simply be the recorder of deeds.

Spectrum use laws would be handed over to the states to define, within constitutional limitations, what the owner can do with the spectrum (just like zoning laws). If someone interferes with your spectrum, then you can take him to court (trespassing).

Under this concept, if there still isn't an amateur radio service which would be provided strictly as a government charity, radio amateurs at large might have to ante up to purchase spectrum and then manage their spectrum themselves.

Even if the ARRL came suddenly to their senses and actually purchased some small spectrum for hobby purposes, information throughput would have to increase ten- to a hundred-fold to compensate for reduced bandwidth availablity! CW, FM, SSB, and RTTY would all be dinosaurs by comparison. New digital modes, including some that haven't even been invented yet, would emerge. At least the spirit of adventure in amateur radio could come alive again.

Anybody could purchase spectrum and start his own amateur radio service, not just the ARRL. This is the intent of reducing FCC authority in the first place. If you don't like the ARRL's service, sign on to someone else's. Remember, whoever gets the most revenue to support their spectrum investment wins.

Steve Katz WB2WIK, Chatsworth CA Rege Dvorsky WA3LKT in his June letter has a lot going for him. He acknowledged that his new grounding system worked because of "potluck." And he expressed an interest in many facets of our hobby which seem to bypass much of the crowd. I agree with him, but I have some suggestions.

It doesn't take money to work the satellites; it takes time, dedication, and ingenuity. I set up a local fellow on OSCAR-13 Mode J with $100 worth of used gear and he's having a ball. We're working on setting him up for Mode S for less than $200, although he'll have to build the uplink transverter from a kit, with which I'll be happily helping him. Since you'll be transmitting and receiving on different bands, fancy equipment really isn't required (although it may be nice and look pretty). I worked the first pass of OSCAR-VI back in 1970 using all home-brewed gear that cost maybe $50 to throw together.

I realize that "turnkey systems" are the idea du jour, and these are fine for those with more money than ingenuity. But you don't have to spend thousands of dollars to get into the satellite game. Your bucks will be better spent home-brewing some small projects and sending a $25 donation to AMSAT, which can use it to help build more satellites.

If you've tried working AO-21 and *Mir* without success ("no luck with my dipole antenna"), I'll bet it was either bad timing, poor operating technique, or less than optimum dipoles causing the problem. And this would not be unusual. Most newcomers to the sats don't really know how to do it—it takes time and experience. There are dipoles, and there are *dipoles*. Some work great; others don't, even though they're cut exactly per formula and resonate perfectly. SWR is no measure of efficiency. Get those dipoles out in the clear, free of obstructions (especially obstructions above the antennas which block their view of the sky), and they'll work fine. I've worked *Mir* with 5 W output from my tuned-down Ten-Tec Scout and a dipole. But my dipole was installed up 60' above the ground, above all the local tree limbs. It makes a huge difference. Find a couple of tall trees and get that wire up in the very top branches.

We've also worked (I say *we* because it was a club operation) the high-altitude sats with QRP from a Field Day site, using exactly 5 W output (and all battery-powered gear) on 70cm to a 16-el, circularly polarized yagi on a 3' tripod that was ground mounted. We did this at K6CAB/6, the club Field Day station for the Conejo Valley ARC here in southern California. Anyone can do it with the right technique. Although we were using a $2,000 FT-736R, the contacts would have been just as easily made with a home-brewed $40 transverter. It doesn't take much to run 5 watts.

I love your attitude, and wish more hams had it. Just take a little more time, use a bit more patience, hone your operating skills until they're razor-sharp, and you can do anything. Ham radio needn't be an expensive hobby. I've been a ham since I was 13 years old (golly, 30 years ago!) and have won major DX contests, but have actually spent more money on skiing equipment, restoring old cars, stamp collecting, and many other hobbies than ham radio ever required. Keep up the good work; you won't be disappointed.

Klaus Kramer DL4KCK, Koln, Germany Wayne, your idea to transmit manuscripts, circuit diagrams, and pictures via FAX equipment on the amateur bands is great, but not exactly new! At least in Germany we have been doing it for many years. In 1971, Manfred May DJ1KF (ex-DC6EU, now AGAF vice president) experimented with Siemens KF-108 fax machines. He adapted their in- and output to amateur radio transceivers and installed the special mode "facsimile" in DL. This AM-FAX mode was very susceptible to interference, so we changed to FM-FAX with modulation frequencies similar to SSTV (1,500 Hz black / 2,300 Hz white). Because of improved fax machines from 3M and Xerox that we adapted to our needs, we were able to exchange nearly photographic quality pictures with many grey levels and even the small, printed text from amateur radio magazines.

The analog fax standard 120 lpm and IOC 288 was used in Europe on the HF bands, while a rising number of VHF-amateurs used 240 lpm and IOC 204 with FM. Since the drum fax machines smelled strange while receiving (chemicals were burnt off the expensive special paper sheets), in the eighties more and more solid-state memory converters were used—for instance, "Wraase SC-1" from DL2RZ. With steadily improved memory chips we were able to display 256 x 256 pixels with 64 grey levels on the attached video monitor, and a "flash-A/D-converter" within the "SC-1" allowed us to store and transmit "live pictures" with nearly TV-quality from a b/w-video camera. Color shots were restricted to typical slow-scan resolutions (128 x 128 pixels), but some hams tried to get higher resolution pictures by collecting the red, blue, and green color portions one frame after another in the fax mode.

At last the rapid development of home computers, especially the Commodore Amiga, gave a decent "kick" to the sending of high-quality picture transmission on the HF bands. In 1988, DF4PV began his first experiments on 80m with an Amiga fax program, written by his younger brother Volker Wertich. This receive/transmit program, plus a little converter board attached to the parallel port, was accompanied by the Amiga-SSTV program which introduced two innovative ideas: The Wraase mode "quasi 96" (color SSTV) can be doubled in duration to 192 seconds by a software switch on the graphic user interface, and by another switch you can suppress the typical sync pulses (1,200 Hz) on transmit and receive. This new mode, called FAX-SSTV, combined the advantages of a low-band color SSTV transmission (only 1,500-2,300 Hz) and the crystal-controlled line sync that is used with FAX (it cannot be interrupted by noise peaks).

At about the same time AEA released the Amiga Video Terminal program and converter, which presented the highest known color picture resolution of all: 320 x 480 pixel in 188 seconds, also working without line sync pulses. The "new modes" (Robot 1200C extensions, Martin 1-4 and Scottie 1-4) took over the "sync free" mode on receive, but only now the JV-FAX program developed by DK8JV supplies the real color fax quality (640 x 480 pixels) that we had dreamed of. With SSB modulation it uses the maximum channel capacity with 360 lpm and IOC 204. In FM it provides better resolution with 240 lpm. The mode is named "ham color" or "JV color."

Meanwhile, the graphic power of the IBM-PC class with all necessary cards has nearly reached Amiga levels, and with JV-FAX version 7.0 all the usual SSTV modes as well as weather fax from satellites and color fax pictures with excellent quality are a reality. Amiga users can choose now between several programs with true color (24 bit) and high-resolution picture transmission. The dream has come alive.

If you are thinking about using normal office fax machines on the amateur bands, that would be a setback in quality and performance. First, the resolution never reaches the possible 256 grey levels of computer fax programs (not to mention the missing colors); and second, office fax transmissions are based on duplex connections with digital signals (max. 9,600 bit/s) and waste too much time at the beginning with a special "training sequence" that finds the highest possible speed for the data transmission. In Germany, some packet radio specialists tried to introduce this mode into their net, but without success. The time lost to connect was too big and data speeds on the SHF links between digipeaters surpass 38,400 bit/s by now. It's better to use old analog fax machines (i.e., 3M2346) as a scanner for photographs and text sheets. Modern amateur fax programs can receive that signal, process and transmit it with high quality.

I am transmitting a fax bulletin once a week on 2m with news and technical information. How about one powerful ham station doing that on every continent? In IARU-Region 1 the entire SSB section of the low bands can be used for FAX and SSTV transmissions. Now hams need to get busy and do it!

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FEATURES:

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Helical resonator filters **may reduce your intermod & cross-band interference.**

MODEL HRF- (*), ***$59 vhf, $99 uhf.***

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Low noise converters to receive vhf & uhf bands on a 10M receiver.

- Input ranges avail: 50-52, 136-138, 144-146, 145-147, 146-148, 220-222, 222-224 MHz, 432-434, 435-437, 435.5-437.5, and 439.25 (atv conv. to chan 3).
- **Kit less case** ***$49,*** **kit w/case & BNC jacks** ***$79,*** **w&t in case** ***$99.***

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XV2 for vhf and XV4 for uhf. Models to convert 10M ssb, cw, fm, etc. to 2M, 432, 435, and atv. 1W output. **Kit only $89 (vhf), $99 (uhf).** *PA's up to 45W available.*

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NEW **CWID-2.** Eprom-controlled, miniature, easy to build, low power CMOS, (specify call) .... **only $54 kit, $79 w/t**

COR-6. **COR & Real Voice ID** on one board. Digital ic records up to 20 seconds of your voice. Can record multiple id messages. Tail and time-out timers, courtesy beep, solid-state relay to key transmitter. .... **kit $99, w&t $149**

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CWID. Diode programmable .... **kit $59**

COR-4. Complete COR and CWID all on one board. CMOS logic for low power consumption. EPROM programmed; (specify call) .... **kit $99, w&t $149**

ACCESSORIES

DVR-1 DIGITAL VOICE RECORDER. Records up to 20 sec. of your voice with built-in mic. or external mic. Terrific as voice ID'er for repeaters or fox hunt xmtr, contest caller, radio notepad, etc. Extensive manual tells how to use multiple messages adapt to many applications. ......**kit $59, w&t $99**

TD-4 SELECTIVE CALLING Module. Versatile dtmf controller with 1 latching output. **Mutes speaker until someone calls** by sending your 4-digit tt code. Or use it with a **long tt zero** digit to alert anyone in club. Also may be used to **control autopatch or other single device.** .... **kit $49, w&t $79**

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AP-3 REPEATER AUTOPATCH. Reverse patch and phone line remote control. .... **kit $89, wired & tested $139**

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9600 BAUD DIGITAL RF LINKS. Call for info on low-cost packet networking system: MO-96 Modem and special versions of our 144, 220, or 450 MHz fm xmtrs and rcvrs. Use directly with most TNC's. Fast, diode-switched PA's output 15 or 50W.

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NEW Get time and freq checks without buying expensive hf rcvr. Very sensitive and selective xtal controlled superhet, dedicated to listening to WWV on 10.000 MHz. ... **only $59 kit, $99 w/t**

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A fully microprocessor-controlled repeater with autopatch and many versatile dtmf control features at less than you might pay for a bare-bones repeater or controller alone!

Kit still only $1095
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50 & 900 MHz bands slightly higher

- Available for the 50-54, 143-174, 213-233, 420-475, 902-928 MHz bands.
- **FCC type accepted** for commercial service in150 & 450 bands. *(Request catalog for details.)*

REP-200T Voice Message Repeater. As above, except includes Digital Voice Recorder. Allows message up to 20 sec. to be **remotely recorded off the air.** Play back at user request by DTMF command, or as a periodical voice id, or both. **Great for making club announcements!**........................**adds only $100!**

REP-200C Economy Repeater. Uses COR-6 Controller (no DTMF control or autopatch). Features **real-voice ID.** ....**Kit only $795, w&t $1195**

REP-200N Repeater. Want to use your own controller? No problem! We'll make you a repeater with rf modules only. .... **Kit only $695, w&t $995**

XMTRS & RCVRS FOR REPEATERS, AUDIO & DIGITAL LINKS, TELEMETRY, ETC.

Also available in rf-tight enclosures, and with data modems.

FM EXCITERS: 2W continuous duty.
FCC type accepted for com'l bands.

- **TA51:** 50-54, 143-174, or 213-233MHz.
- **TA451:** 420-475 MHz . *New low price!*

Either model: ....**kit $99, w/t $169.**

- **TA901:** 902-928 MHz, (0.5W out); *New low price!* .... **w/t $199.**

VHF & UHF AMPLIFIERS. For fm, ssb, atv. Output levels from 10W to 100W. Models **starting at $99.**

FM RECEIVERS:

NEW **R100 FM RECEIVERS** for 46-54, 72-76, 140-175, or 216-225 MHz. **Very sensitive** – 0.15uV, **exceptional selectivity** – both crystal & ceramic if filters for >100dB at ±12kHz (best available anywhere), **flutter-proof** squelch. ....*New low price!* **kit $129, w/t $189.**

- **R451 FM RCVR,** for 420-475 MHz. Similar to above. *New low price!* **kit $129, w/t $189.**
- **R901 FM RCVR,** for 902-928MHz. Triple-conversion. *New low price*.... **$159, w/t $219.**

NEW **R150 MONITOR RCVR** for 143-164 or 216-225 MHz. 4-channels. Great for monitoring repeaters, amateur calling frequencies, packet radio, commercial two-way radio, police/fire frequencies, or weather forecasts. **Good starter kit,** easy to assemble and align........**kit only $99, w/t $189.**

- **R120 AIRCRAFT RCVR** for 110-136 MHz....................... **kit only $99, w/t $219.**

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NEW **Our R138 Is The Most Affordable WeFax Receiver!** We used our 30+ years of experience in designing high-quality vhf receivers to bring you this enhanced version of our long-popular WeFax Receiver, a very sensitive wideband fm receiver especially for amateur reception of NOAA and Meteosat weather facsimile images on the 137 MHz band. Use with demodulators and software from MultiFax, S.S.C., A&A Eng., and others. Features 0.2µV sensitivity, wideband filters for low distortion, and four crystal controlled channels at a fraction of the cost and complexity of synthesized units. Optional Scan Adapter allows you to automatically search for and record signals as satellites pass overhead while you are away from the shack.

- **R138 Receiver** ....**$129 kit, $189 w/t**
- **AS138 Scan Adapter**....................**$39 kit, $69 w/t**
- **Channel Crystals** .... **$12 ea**
- **ARRL Weather Satellite Handbook**................ **$20**

- Buy at low, factory-direct net prices and save!
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QRX . . .

Number 3 on your Feedback card

Super Elmer!

Toby Metz KB7UIM has a great thing going with the Voice of Idaho Amateur Radio Club. Toby's Eagle Scout Service Project involves taking a small group of deaf people, teaching them what they need to know to get their ham tickets, and then getting them on packet! The city of Boise has donated computers and radios for the cause. The VOI Club bought the TNCs and crystals for the radios. Then, through a money-raising project, Toby earned enough to get the rest of the items needed to complete the project, like power supplies and antennas. One person, Bill Blohm KC7JSD, has already gotten his Tech and is well on his way to General. Two others, a nine-year-old and a twelve-year-old, are going for their no-code Tech tickets. Heather Whitestone, Miss America, sent Toby and his students autographed pictures and personal notes of encouragement. Way to go, Toby!

Wayne On-Line!

Yep, if you check the Prodigy Hobby Bulletin Board, Ham Radio division, you'll find good old Uncle Wayne...whenever he has the time. Now, via Prodigy, you can be the 42,478th person to tell Wayne that you don't always agree with his editorials. Maybe Wayne should issue a certificate. Ten dollars if you don't always agree with him. And $5 if you do. Now you know where to find him, with no problems of propagation or QRM.

Good Club!

The Port St. Lucie (Florida) Amateur Radio Association gets a gold star. (1) Their newsletter is interesting and informative. (2) The club is sponsoring hidden transmitter hunts. (3) They're active in all sorts of community projects, such as providing communications for the American Heart Association annual Bike-A-Thon, a March of Dimes Walk-A-Thon, and a Blessing of the Fleet. And how about the ham PR of holding their Field Day effort on the front lawn of City Hall! Instead of in the boondocks somewhere!

ARLS007 SAREX STS-70 Postponed

Space Shuttle Mission STS-70, which is scheduled to carry the Shuttle Amateur Radio Experiment, has been postponed. Mission managers have decided to repair damage done by woodpeckers in the foam insulation of the external fuel tank. The foam prevents ice from building up on the tank. The repairs will be done at the shuttle Vehicle Assembly Building, requiring the Space Shuttle *Discovery* to be removed from the launch pad during the week. The mission may be rescheduled for sometime in August.

Mission STS-71, which will also carry the Shuttle Amateur Radio Experiment, is still scheduled for no earlier than June 22. Following a Flight Readiness Review last Friday, mission managers decided not to select an official launch date due to ongoing work aboard the Russian *Mir* Space Station that needs to be completed prior to the Space Shuttle *Atlantis'* rendezvous and docking. The launch team at the Kennedy Space Center will continue vehicle processing work so that *Atlantis* will be ready for launch anytime on or after June 22. An official launch date is expected to be announced in about one week.*TNX ARRL, KC5BTL, and Kennedy Space Center Public Affairs Office*

10 GHz Activity

The Rochester Group VHF Journal reported on a wonderful opening across Lake Ontario. Bob Golden VE3OIK, set up on a hill, gave the Rochester hams an exciting time, with S-9 signals as they moved in 10-mile jumps along the shore. Not bad for an 85-mile hop on that band! The Journal points out that there is a need for more 10 GHz beacons. There are only a dozen in the US, compared to 10 in the UK and 30 more in Europe. The result is that most of the band openings are never noticed. But even when there is no opening, the 10 GHz band has plenty of uses, such as replacing wasteful 450 MHz repeater links. Uncle Wayne managed to work seven states on the band, with the longest path over 100 miles, and none shorter than 50 miles. Either use the band or face losing it. The Journal has lots of info on gear and operating, so send $10 to subscribe to Rochester VHF Group, Box 92122, Rochester NY 14692. Do it NOW!

Six Meters Open For The Summer

The more adventurous Techs are setting up camp on 6m and enjoying the usual summer openings. The band can sound like 20m at times. W4OO reports contacts all through W2 and 3, KP4, V31, TI2, and so on. Often the whole midwest is pouring through into Florida. The least you can do is get a rig and good antenna set up for 6m and start listening for the many beacons. Thanks to the North Florida Amateur Radio Society's *Balanced Modulator.*

Rescue at Sea

Amateur Radio has once again been a life saver on the high sea. The crew of a yacht that nearly sank off the Mendocino coast is safe and back on dry land. This, thanks to a Ham radio operator in Canada who picked up their distress signal when Coast Guard officials nearby could not. The 36-foot ketch lost its rudder and was drifting helplessly in 24-foot waves off Point Arena Thursday, June 1st, when Doug Burrows in Alberta heard their faint mayday calls on his radio.

Burrows called the U.S. Coast Guard in San Francisco, which dispatched a cutter and helicopter. The three crew members, who stayed with their boat, arrived at the Coast Guard Station Golden Gate the following day. The yacht was towed in by a Coast Guard patrol boat. *TNX Amateur Radio Newsline*

Free Speech Limited!

In addition to not being legal to yell FIRE! in a crowded theater, you are also not allowed to screw up a repeater to demonstrate your mental imbalance. Repeater trustees can ban any user they please, according to the FCC and backed by the courts. It's a pity when a club has to get a court order restraining some nut case ham from using a repeater. But then, while we have a filter (the code) to keep 90% of aspiring hams out of our exclusive club, we have no sanity test.

"Sky Night" Forming!

Would your ham club like to coordinate with astronomy clubs in your area to conduct a joint public "Sky Night" event, centering on the Perseid meteor shower? Activities would include visual observation, meteor-trail-bounce communication, conversations with other Sky Night sites around the country, and an opportunity to send messages to friends in other cities via National Traffic System nets.

Interested parties should send contact information to Peter Coffee AC6EN (E-mail: CompuServe 72631,113, or Internet 72631.113@compuserve.com) to help in planning this event. *TNX AC6EN*

Show Airs on Shortwave

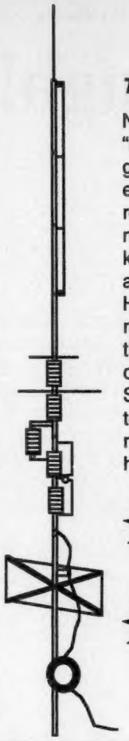
On June 5th, the weekly ham radio talk show "Ham Radio and More," produced and hosted by Len Winkler KB7LPW, began airing on WWCR, tape-delayed, twice per week. Listen for it each Monday at 3:00 AM ET on 7.435 MHz and again every Saturday at 5:00 PM ET on 12.60 MHz. *TNX Amateur Radio Newsline*

FCC on the Internet

The FCC has instituted a homepage (http://www.fcc.gov) as an entry point to the Commission's on-line resources. The page features selectable buttons to go directly to high-interest items such as the Daily Digest, the Commission Agenda, Auctions, and current rule makings.

A button called ""Getting Information" provides a tour of what information is available and where it can be found on the site, and provides links to available on-line documents. There also is a link to the FCC telephone directory.

A general mailbox for electronic mail to the FCC is: fccinfo@fcc.gov. *TNX ARRL*



A NO-RADIAL VERTICAL
THAT COVERS 80 OR 75 METERS?

THERE'S ONE NOW!

No, we won't insult your intelligence by telling you that it's a "halfwave" or that ANY vertical will operate more efficiently without a good radial system than with one; it certainly won't! If you want expensive fairy tales talk to our competitors! If, however, you've no room for even the smallest radial system just install the most efficient multiband vertical in the business, the HF9V-X, over our counterpoise kit. You'll not only save a tidy sum but you'll work DX that the shorter and more lossy no-radial "halfwaves" can't touch because both the HF6V-X and HF9V-X use longer active element lengths for higher radiation resistance and greater efficiency on more bands than any of the so-called halfwaves. Ask for our free brochure for complete specs on all Butternut models and receive technical note DLS-1 "Dirty Little Secrets from the Antenna Designer's Notebook") that shows you how to calculate the probable efficiency of any vertical antenna using the manufacturer's own specs so you won't have to learn the truth the hard way!

NEW! **Model HF9V-X (shown to the left) for 80/75, 40, 30, 20, 17, 15, 12, 10 and 6 meters.**

NEW! **Model CPX counterpoise kit for Butternut models HF9V-X, HF6V, and HF6V-X; substitutes for ground or elevated radials. Self-supporting tubing bolts onto base of antenna. Mast not provided.**

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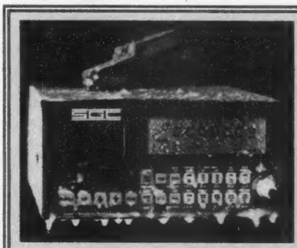

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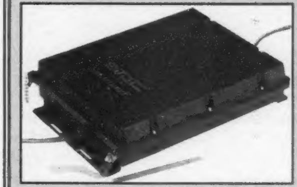
The SG2000 HF transceiver is type accepted for commercial and marine service made with traditional U.S. commercial radio quality (and of course it can be used on the ham bands also). While the Japanese radios have 2 final transistors that strain to put out 100 watts on the low bands and only 75-85 watts on ten meters, the SG2000 has 4 large transistors that loaf along at 150 watts on ALL THE BANDS INCLUDING 10 METERS! Some of the SG2000 features are: 1) A control head remotable (no special kit necessary) up to 150' away from the rig, perfect for automobiles and boats. Up to 8 heads can be utilized and used as intercoms also. 2) The largest display of any HF transceiver. 3) 644 pre-programmed memories and 100 user programmable memories. 4) operable from -50F (-45C) to 185F (+85C). You want quality right? Here is what EVERY SG2000 must endure before they're shipped from the factory: 1) They're factory aligned, 2) EVERY SG2000 is keyed down at full power (CW 150 Watts) into an open antenna for about 10 seconds, then connected to a shorted antenna and keyed down for an additional 10 seconds. 3) EVERY SG2000 is put in the "BURN-IN" rack and keyed down for 24 hours non-stop at full power CW. Don't try that with the foreign radios. 4) EVERY SG2000 is then re-checked for alignment and put in the "TORTURE RACK" where they are keyed on and off every 10 seconds for 24 hours. 5) The SG2000 is then re-evaluated and all control functions are verified to ensure that the microprocessor is up to spec. THEN AND ONLY THEN IS THE SG2000 ALLOWED TO LEAVE THE FACTORY.
The bottom line is price, you know how expensive commercial rigs are normally, we are selling the SG2000 BELOW DEALER COST at only $1,449.00 each!! That's a $400.00 savings! We guarantee the best price.



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Tube TNC: A Packet Breakthrough!

Have the hottest packet signal on the air.

by Phil Anderson W0XI

At the recent Tucson Amateur Packet Radio (TAPR) annual meeting in St. Louis, one of the presenters proposed yet another TNC. A prominent amateur in the audience then challenged this presenter to justify such a project, asking "Why do we need another TNC?" This reminded me of an idea that had been circulating within my own cranial LAN a few months before: How many tubes would it take to make a TNC and what would its specs be like? Well, here goes.

Concept

First things first, what do we want our Tube TNC (TT) to look like? Should it be super simple, or should it match the features of one manufactured today? Since this choice is arbitrary and I'm familiar with the Kantronics KPC-3[1], let's make our TT look like it. As you may know, a basic KPC-3 ships with 32K of random access memory (RAM), 512K bits of erasable programmable read-only memory (EPROM), a 63B03X Hitachi microprocessor (µP), and a 3105 Texas Instruments (TI) 1,200-baud modem. In addition to these large-scale integration (LSI) parts, it contains some additional chips: one DS14C88, two 74HC14s, two 74HC00s, a crystal, resistors, and capacitors.

Design

Second, now that we've picked a TNC for comparison, how many tubes will the TT need to have? This second question is not so simple. The 63B03X µP data sheet doesn't indicate how many transistors there are within the chip! However, my copy of the *Reference Data for Radio Engineers* (RDRE) gives us a good enough estimate: The 6502—the popular early-days workhorse—contains 5,000 transistors in its 160- by 160-mil chip! Assuming all the other chips in the KPC-3 have fewer transistors than the processor, I'm going to estimate that the KPC-3 contains roughly the equivalent of 10,000 transistors. Wait, don't yell yet! I'm not counting the SRAM and EPROM. You see, we'll have to use *core* memory in our TT.

Third, we'll have to pick an appropriate tube. Hams licensed 50 years may object, but I've selected the 6EV7, a relay control twin-triode by RCA[2]. Its physical outline is pictured in Figure 1 and additional features are listed below:

- two triodes in one tube
- 250 VDC B+
- 2.5 watts plate dissipation!
- miniature 9-pin socket

With these "facts" in hand, we can begin to picture our TT. By the way, for tradition, let's call it the TT-1. It's going to be big, it'll consume a lot of power, and it must by necessity use magnetic-core memory. If we don't use core memory, the number of transistors for the beast will simply grow way beyond the 5,000 I envision. I'm assuming, of course, since we smartly picked a twin-triode, that we'll need only 5,000 transistors (rather than 10,000) to replace the KPC-3's micro-processor, modem chip, and associated glue logic.

While a 6EV7 consumes just a few cubic inches of volume real estate, we can't expect to pack them against each other. That is, we can't assume the size of TT-1 will be just 5,000 times the volume taken by just one 6EV7. I just went downstairs and measured my refrigerator—not sure why—and its dimensions are 22 by 30 by 60 inches (39,600 cubic inches). While five thousand 6EV7s would fit in there, it would be way too hot; we're talking about generating nearly 25,000 watts. That's the equivalent of four hundred sixteen 60-watt light bulbs turned on continuously!

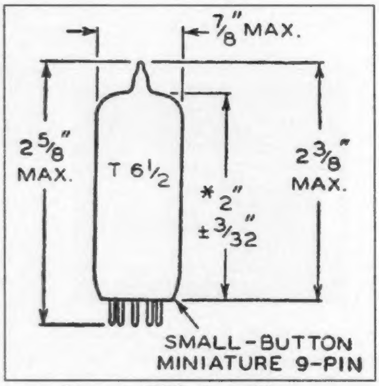


Figure 1. 6EV7 physical layout.

TT-1 Performance

Question: Would the Tube TNC, dissipating 25,000 watts continuously, heat your house?

Answer: A typical house in Kansas City, according to my high-efficiency furnace brochure, demands 2,000 heating load hours per year, and the average load is 70,000 BTU/hr. So, it would seem that the average house in KC needs roughly 140 million BTU/year. Additionally, the specs for my furnace indicate that it puts out 96% of the rated input capacity, or 124,000 BTU/hr. Thus, my furnace is capable of supplying the "heat" I need in roughly 1,000 heating hours per year. I pay $0.37 per one-hundred cubic feet of gas (ccf) and I use about 1,000 ccf per year. So, my yearly gas heating bill is $370.00. Not bad.

The question still remains: Can the Tube TNC supply these needed BTU? Our TT-1 dissipates 219,000 KW-H, so we need to relate that to BTU. My thermodynamics book[3] appendix gives us the answer:

1 KW-H = 3360 BTU, so

219,000 KW-H = 735 million BTU

That means our Tube TNC is capable of heating roughly five houses. It's a heat-LAN!

So what have we got? Let's list TT-1's features:

Power: 25,000 watts

Display: Christmas bulbs, for TX, RX, CON, ACT, and MAIL!

Tubes: 5,000 twin-triodes

Data memory: 256,000 cores for the "RAM" program

Memory: 512,000 cores for the "EPROM"

By the way, the RAM memory feature listed is really neat. You no longer have to worry about battery-backed RAM for your mailbox. The cores retain their individual "bits"—a one or zero—without power! We've got a really neat display, too; you have your own supply and can change them every Christmas: colored lights! You won't need a home furnace any more, either, for TT-1 puts out the BTU!

Operational Cost

But there is one big problem! This beast will cost you an arm and a leg in electrical bills if left on continuously as a digipeater or node. Here's my calculation, based on KW-H power rates for Kansas City:

Kilowatt-Hours/year = 25,000 watts x 24 hours x 365 days = 219,000 KW-H

Yearly electric bill = # kilowatt-hours x $/KW-H = 219K x $0.10 = $21,900

Maybe we should settle for programming a bit more modern computer. Perhaps we could use a Digital Equipment Corporation PDP-8 or PDP-12, or perhaps we could use an IBM System Model 50. On second thought, perhaps we ought not to build this project!

References

1. *KPC-3 Reference Manual,* Kantronics, Inc, 1995.
2. *RCA Receiving Tube Manual,* RCA, 1961.
3. *Basic Engineering Thermodynamics,* Zemansky, McGraw Hill, 1975.

10 Bands -- 1 MFJ Antenna!

Full size performance . . . No ground or radials

Operate 10 bands: 75/80, 40, 30, 20, 17, 15, 12, 10, 6 and 2 Meters with one antenna
Separate full size radiators . . . End loading . . . Elevated top feed . . . Low Radiation Angle . . . Very wide bandwidth . . . Highest performance no ground vertical ever . . .

Operate 10 bands -- 75/80, 40, 30, 20, 17, 15, 12, 10, 6 and 2 Meters -- with this MFJ-1798 vertical antenna and get *full size performance* with no ground or radials!

Full size performance gives you high efficiency for more power radiated. The result? Stronger signals and more Q-5 QSOs.

Full size performance also gives you exceptionally wide bandwidths so you can use more of your hard earned frequencies.

Full size performance is achieved by using separate full size radiators for 2 through 20 Meters and highly efficient end loading for 30, 40 and 75/80 Meters.

You get very low radiation angle for exciting DX, automatic bandswitching, omni-directional coverage, low SWR and it handles 1500 watts PEP SSB.

MFJ's unique *Elevated Top Feed*™ elevates the feedpoint *all the way to the top* of the antenna. It puts the maximum radiation point high up in the clear where it does the most good -- your signal gets out even if you're ground mounted.

It's easy to tune because adjusting one band has minimum effect on the resonant frequency of other bands.

Self-supporting and just 20 feet tall, the MFJ-1798 mounts easily from ground level to tower top -- on small lots, backyards, apartments, condos, roof tops, tower mounts.

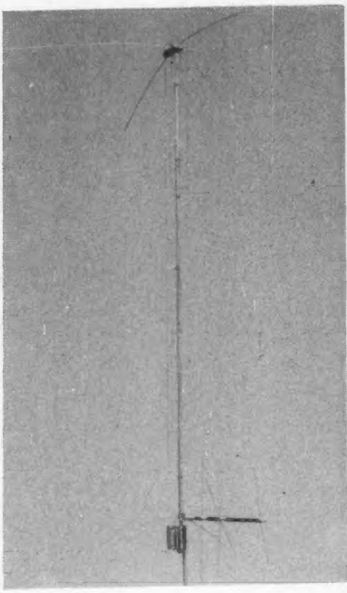
Separate *Full Size* Radiators

***Separate** full size* quarter wave radiators are used on 20, 17, 15, 12, 10 and 2 Meters. On 6 Meters, the 17 Meter radiator becomes a 3/4 wave radiator.

The active radiator works as a stub to decouple everything beyond it. *In phase* antenna current flows in all parallel radiators.

This forms a very large equivalent radiator and gives you incredible bandwidths.

These radiator stubs provide automatic bandswitching -- there is absolutely *no loss* due to loading coils or traps.



MFJ-1798
$269.95

End Loading

On 30, 40, 75/80 Meters, end loading -- the most efficient form of loading -- gives you highly efficient performance, excellent bandwidth, low angle radiation and automatic bandswitching.

MFJ's unique *Frequency Adaptive L-Network*™ provides automatic impedance matching for lowest SWR on these low bands.

Tuning to your favorite part of these bands is simple and is done at the *bottom* of the antenna.

No Ground or Radials Needed

You don't need a ground or radials because an effective counterpoise that's 12 feet across gives you *excellent* ground isolation.

You can mount it from ground level to roof top and get awesome performance.

No Feedline Radiation to Waste Power

The feedline is decoupled and isolated from the antenna with MFJ's exclusive *AirCore*™ high power current balun. It's wound with Teflon® coax and *can't* saturate, no matter how high your power.

Built to Last

Incredibly strong solid fiberglass rod and large diameter 6061 T-6 aircraft strength aluminum tubing is used in the main structure.

Efficient high-Q coils are wound on tough *low loss* fiberglass forms using highly weather resistant Teflon® covered wire.

Teflon® is registered trademark of Dupont

MFJ *Super Hi-Q Loop*™

MFJ-1786
$299.95

MFJ's *tiny* 36 inch diameter *high efficiency* loop antenna lets you operate 10 to 30 MHz *continuously* -- including the WARC bands!

It's ideal where space is limited -- apartments, small lots, mobile homes, attics, motor homes.

Enjoy both DX and local contacts when you mount it vertically. You get *both* low angle radiation for excellent DX *and* high angle radiation for local close-in contacts. Handles 150 watts.

Super easy-to-use! Only MFJ-1786 *Super* Remote Control has *Auto Band Selection*™. It auto-tunes to your desired band, then beeps to let you know. No control cable is needed.

Fast/slow tune push buttons and built-in two range *Cross-Needle* SWR/Wattmeter lets you quickly tune to your exact frequency.

All *welded* construction, no mechanical joints, welded butterfly capacitor with no rotating contacts, large 1.050 inch diameter *round* radiator -- not a lossy thin flat-strip -- gives you highest possible efficiency.

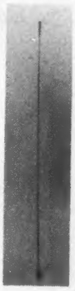
Each plate in MFJ's *superb* tuning capacitor is welded for low loss and *polished* to prevent high voltage arcing. It's welded to the radiator, has nylon bearing, anti-backlash mechanism, limit switches and a continuous *no-step* DC motor for *smooth precision* tuning.

A heavy duty 1/8 inch thick ABS plastic housing with ultraviolet inhibitors protects it.

MFJ-1782, $269.95. Same as MFJ-1786 but remote control has only fast/slow tune buttons.

Super 80/40M Vertical

MFJ-1792
$159.95



Designed as a *high performance* antenna for 80 and 40 Meters, the MFJ-1792 features a *full size* quarter wave radiator for 40 Meters - - that's a full 33 feet of ruthless radiating power.

End loading -- the most efficient form of loading -- is used for 80 Meters. It's accomplished by a virtually lossless 4½ foot capacitance hat and a high-Q coil wound with Teflon® wire on a *low-loss* fiberglass form.

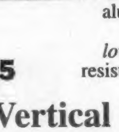
The *entire length* radiates power.

High strength 6061-T6 aluminum tubing, super strong solid fiberglass insulator, *Frequency Adaptive L-Network*™, heavy duty *swing* mount. Handles 1500 watts PEP. Requires guying and radials, counterpoises or ground screen.

MFJ-1793, $179.95. Same as MFJ-1792 but includes *full size* 20 Meter quarter wave radiator.

Box Fan Portable Loop

MFJ-1780
$229.95



No, it's not a fan -- it's a high efficiency portable loop antenna that's about the same size and shape as a 2x2 foot box fan, complete with carrying handle.

Carry it like a suitcase, tuck it in a corner of your car or check it as baggage on a plane.

When you get there, set it on a table or desk and enjoy ragchewing or DXing.

All welded construction, covers 14-30 MHz *continuously* including WARC bands, handles 150 watts. Remote control has fast/slow tune buttons. S

MFJ *halfwave* Vertical

6 bands: 40, 20, 15, 10, 6, 2 Meters . . . No radials or ground needed!

MFJ-1796
$199.95

Operate 6 bands -- 40, 20, 15, 10, 6 and 2 Meters -- with this MFJ-1796 *ground independent halfwave* vertical antenna! No radials or ground ever needed!

It's only 12 feet high and has a *tiny* 24 inch footprint! Mount it anywhere from ground level to tower top -- on apartments, condos, small lots, even motor homes. Perfect for vacations, field day, DX-pedition, camping.

Efficient *end loading*, no lossy traps. *Entire length* is always radiating. *Full size* halfwave on 2 and 6 Meters. High power *air-wound* choke balun eliminates feedline radiation. Adjusting one band has minimum effect on other bands.

Automatic bandswitching, low radiation angle, omni-directional, handles 1500 watts PEP. Goes together in an afternoon.

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CIRCLE 86 ON READER SERVICE CARD

Number 5 on your Feedback card

VE7PMR Packet Solar-Powered Node

Is packet worth nearly freezing on a mountain? Sure!

by Dennis Wilsher VE7EMS

Penny Mountain Packet Repeater, at 6,400 feet above sea level in the Rocky Mountain Trench in northern British Columbia, Canada, came into operation on September 3, 1993. Designed to operate in lightning storms, winds up to 120 mph, -54° F temperatures, 15-foot snowfalls, it does it all without missing a beat.

Background

Having been raised in that area in my childhood, I was more than familiar with the extreme conditions old Mother Nature can play on anything man might attempt to put together . . . or try to keep running. There are the grizzly bears, porcupines, and wolverines that like to chew up snowmobile seats or just roll things over to see what is under them.

Early in 1993 I sat down with Frank VE7ENX in McBride, and the subject came around to building a link, whether VHF voice or packet, to Prince George from McBride. I bounced the idea around about putting a packet node on Penny Mountain, where Rocky Mountain Trench does a 45-degree bend to complete the 150-mile distance to the nearest BBS at Prince George. Frank was pretty enthusiastic about the idea.

Researching

Access to the mountain is up an old forestry road made in the early 1960s; but since the game (grizzly) use the road as a trail quite regularly, it is well worn. Also a private cabin is located about half a mile below the summit, completely outfitted for one occupant. What a bonus!

I bought a small DT50 motorbike to get up the mountain to check the path in June. My first attempt had me leaving Prince George at 4 AM and getting to the bottom of the mountain via a new logging road. I took along a couple of two-gallon gas jugs and a car battery strapped to the front of the bike, a dual-band antenna, a laptop, my 741A Kenwood, and a PK-88. My new DT50 powered out halfway up the mountain. I tried pushing the bike but, because I was a smoker, I had to lie down and almost had a heart attack right there. Then it started to hail!

At this point I almost gave up on the whole idea, but I figured I might as well see if a packet contact to P. G. was possible. With a garbage bag over the radio equipment sitting on the motorcycle seat, I connected to YXS 50 miles away with only 5 watts. Great!

Photo A. The PMR machine comes in for a landing.

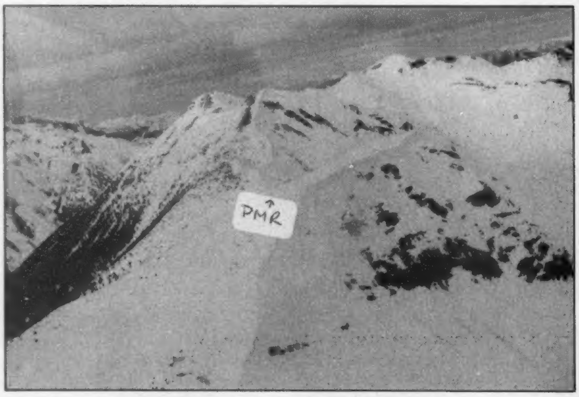


Photo B. A view of the PMR from the air.

I turned around and went back to civilization to regroup—tired, wet, and exhausted.

Stan VE7SSS and I went to the local library and spread out topographical maps over half the library to check the path from his BBS-VE7FG to Penny Mountain. We concluded that it would be close, but we would clear Tabor Mountain by 300 feet.

I sold the DT50, bought a TY250 trail bike, and left again in July with the same equipment (but with extra jets to re-jet the carb at the higher elevation). I made it to within 200 feet of the top, but I chickened out because it got too steep for my limited bike experience to cope with. Voice operation was good as I walked around with my 2-1/2-watt handheld. There wasn't a repeater for 120 miles around that I couldn't raise.

I set up the packet station and connected to Prince George and to McBride with no sweat, running 4 watts to a mag-mount antenna sitting on a rock.

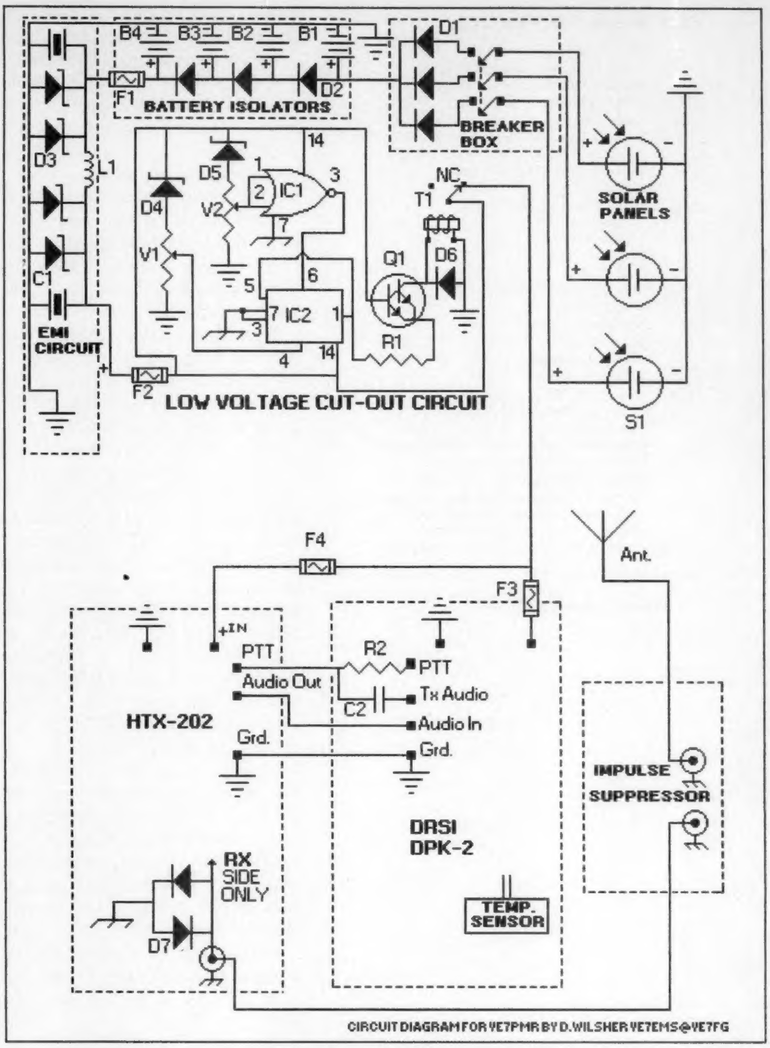
As a wicked-looking storm was coming in from the east, my time was limited. I moved down the slope to the south about 200 feet to try another path. The idea was to put the node below the summit so as not to attract lightning and to keep it from hearing nodes in Alberta. I also wanted to pick a spot where the wind would keep the snow build-up below the solar panels in the winter.

It worked great and the signals were off the scale. To mark the point, I sprayed the rocks and moss with fluorescent red paint.

Putting It Together

Next I went to local clubs to sell the idea. After explaining to them where Penny Mountain was and what I was planning, a few local packet experts said it couldn't be done. The handheld and batteries would freeze; lightning would blow it up; solar panels would not work in this country; it's hard to access; and on and on. Hmmm . . . guess we would have to design it to overcome all these problems.

I contacted a helicopter company and was told that 700 lbs. was all they could lift to 6,400 feet, at a charge of $1,000 per hour. As I hadn't won the lottery lately, I decided I would have to figure out some way to get the system up to the site for free.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B3
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BATTERY ISOLATORS
BREAKER BOX
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D5
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3
2
IC1
NC
T1
D4
V2
7
SOLAR PANELS
V1
D6
Q1
6
5
C1
7 IC2
1
3
EMI CIRCUIT
4
14
R1
F2
LOW VOLTAGE CUT-OUT CIRCUIT
S1
F4
Ant.
F3
+IN
PTT
R2
PTT
Audio Out
Tx Audio
C2
Audio In
HTX-202
Grd.
Grd.
IMPULSE SUPPRESSOR
DRSI
DPK-2
RX SIDE ONLY
TEMP. SENSOR
D7
CIRCUIT DIAGRAM FOR VE7PMR BY D.WILSHER VE7EMS@VE7FG

Figure 1. Circuit diagram.

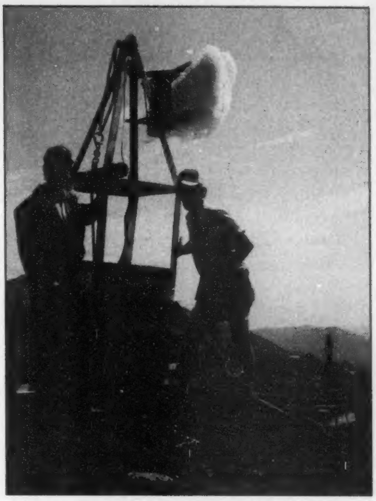

Photo C. Author Dennis VE7EMS and Shorty VE7HRC after the landing. Says Dennis of the "Mars or Bust!" sign, "This unit is a lot cheaper than the failed Mars explorer . . . and it works!

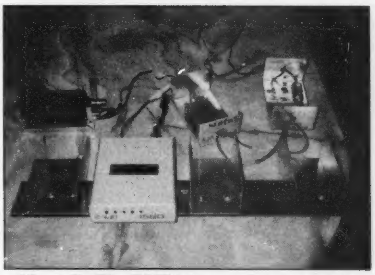

Photo D. The PMR's internal components.

Photo E. VE7HRC (on ground) and VE7EMS (atop the unit) work on the "solar lander module."

For the structure, I realized I would have to design something that would be light but strong, and that would not blow over. So why not copy the Apollo lander idea?

To keep the components and batteries dry and somewhat warm, I took a donated, dead 12-cubic-foot deep freezer, removed the compressor, and filled the empty compartment with spray insulation foam. I then insulated the outside of it with another 3" by laminating it with styrofoam SM using a half-dozen or so silicon tubes. This gave me an additional R-30 insulating factor. The wiring to the panels was old 14-gauge electrical cable, steel-jacketed to protect it from the elements and "critters."

I put the freezer inside a welded 2" by 2", 1/8"-thick angle iron structure, 3" by 3", 1/8"-thick angle iron construction at the base, and 4-foot legs with adjustable feet for strength. All angle iron was welded together solidly using 7018 rod (rated at 70,000 psi). I did not want the unit falling apart when lifted by helicopter. I managed to keep the unit's weight (with the 200 lbs. of batteries) down to a total weight of 700 lbs., but it was close.

The batteries are vented through the bottom of the freezer by a system of aquarium tubes in series, with the vent caps drilled and plastic Ts glue-gunned into the caps. This prevented the inevitable explosion hydrogen gas would make if not vented properly. My wife Tracy VE7TLW gets credit for the battery-venting idea.

The airtight condensation problem was cured by changing silicon gel capsules (donated by pharmacist Dan VE7PHA) in the freezer every year.

Circuitry

Radio Shack's HTX-202 hand-held transceiver draws only about 65 mA on receive. The DPK2 DRSI drew less than 50 mA before the deviation kit was installed. The low-voltage cut-out circuit draws only about 15 mA and is designed to prevent the batteries from discharging below 12 volts, which would reduce their life expectancy and let them freeze as their specific gravity fell with temperature. Wires and coaxes were kept as short as possible. I soldered any connection that I could. For any I couldn't solder, I used conductive silicon grease.

I was only able to acquire batteries of different capacities; therefore, I installed isolation diodes between them, resulting in a voltage drop of 0.34 V across each diode. This meant that when the voltage was at 12 volts at B4, the actual voltage was 13.02 maximum at B1.

The EMI protection circuit I built (designed for me by Chris VE7EQN) is equivalent to some $200 commercial units.

To protect the GaAsFETs at the front end of the HTX-202, I soldered two diodes back to back across the input of the front end. There was no noticeable reduction in sensitivity (per ARRL recommendations of a lightning spike nearby of over 0.2 V).

Install

After contacting several helicopter companies while I was building the unit, I lucked out by running into Northwood Pulp & Timber, Ltd. They not only transported the unit to the top of the mountain but took three of us up and brought us back for free. The night before we set out on our journey, we loaded the node on the box of my pickup and tied it down, with the help of seven amateurs. We left the next morning and arrived at the bank of the Fraser River, seven miles from the site, right on time to meet the helicopter. Shorty VE7HRC, Randy VE7AMS, and I were transported up to the mountain. While the helicopter went back to get the unit, we looked for the spray-painted spot. It was gone! I had used environmentally safe paint. Uh-oh . . .

As the helicopter had the unit by now and would be back to the site in four minutes, we had to think fast. I looked around and made an educated guess concerning where I had made the path check in July, and stood on the spot just as the helicopter was coming over the ridge with the unit.

Successful landing! The weather was beautiful, about 70° F with just a slight breeze. We leveled the unit with the adjustable legs, unwrapped the protected solar panels, and mounted the initial 5/8" PVC-protected antenna.

We drove five lightning rods three feet down into the overburden and connected each leg of the structure to a rod. All the components inside were grounded separately to a fifth. A sixth ground rod was driven in at the peak, in hopes of attracting any nearby lightning strike to it, rather than the node. I then proceeded to paint the structure with tremclad rust paint.

Our two hours were now up and the helicopter was on its way back to get us. I fired up the node at 2:30 PM on September 3, 1993, and Frank VE7ENX in McBride was happily packeting to Prince George's BBS-VE7FG. We all jumped into the helicopter and left the site with our mission successfully completed.

VE7PMR Solar Node Parts List

Ref. No.	Qty.	Description
S1	3	1-amp 20-V commercial solar panels
D1	3	1N5401TR (3-amp 100-V) diodes
D2	3	ECG 5812 (6-amp 100-V)diodes
F1	1	5-amp fuse
C1	2	Siemens Type B1-C75 (75 V breakdown voltage)
D3	4	1.5KE16CA (16.00 V breakdown voltage)
L1	1	4 turns 2" W of #14 (solid) wire
F2	1	5-amp fuse
V1	1	1k pot (set at 12 V)
V2	1	1k pot (set at 11 V)
D4, D5	2	5-V zener diode
1C1	1	ECG 4001
1C2	1	ECG 4013
Q1	1	NPN Darlington transistor
D6	1	1N4003 diode
F3	1	2-amp fuse
F4	1	500-mA fuse
R1	1	3,000-ohm resistor
R2	1	2,200-ohm resistor
C2	1	0.1-µF capacitor
T1	1	40-mA 12-V relay SPST 6-amp contacts
D7	2	1N914 diodes
HTX-202	1	Radio Shack (set at 3 watts, squelch opened)
DPK-2	1	DRSI DPK-2 1,200-baud TNC
IMPULSE	1	IS-B50 Polyphaser Corp.
Antenna	1	commercial Fiberglas, 18-ft. long, 6-dB gain
B1	2	1,000-amp 12-V deep cycle batteries
	1	1,000-amp 12-V conventional battery
	1	700-amp 12-V conventional battery

VE7PMR Remote Readings

```
PMR:VE7PMR} WELCOME TO PENNY MTN.
adc
PMR:VE7PMR}
2.3 Deg C
13.1 DC V
mh
PMR:VE7PMR}
Callsign      Pkts          Port         Time          D e v .
Type
VE7EMS        421           0            0:0:0         2.9
VE7FG         9019          0            0:0:3         2.5
PMR           475           0            0:0:6         2.9
VE7PAD        2087          0            0:0:18        2.4
VE7HRC        100           0            0:51:17       3.1
VE7DTI        1             0            3:43:52       2.5
VE7DPG        164           0            7:48:38       2.8
VE7ENX        16            0            10:58:40      2.4
stats
PMR:VE7PMR} Statistics
L1 Tx % : 8 8 0 3 6 0
L1 DCD% : 33 24 39 68 55 8
L1 RxOvr: 0 0 0 0
L1 TxUnd: 0 0 0 0
L2 RxCRC: 92 0 170 0
L2 heard: 385 0 836 0
L2 recvd: 242 0 121 0
L2 sent : 260 5 166 12
L2 RxRNR: 0 0 0 0
L2 RxREJ: 0 0 0 0
L2 TxRNR: 0 0 0 0
L2 TxREJ: 0 0 0 0
L2 fails: 0 0 0 0
L3 g'wyd: 0 0
L4 recvd: 0 0
L4 sent : 0 0
Buffers : 687 681 695 686 685 693
CPU loop: 516 526 560 523 525 566
Timers : 1352 5184
i
PMR:VE7PMR} Penny Mtn.6400 ft.
Solar System 3 watts
On Air Sept.3/93
VE7EMS Dennis 564-9396
btext
PMR:VE7PMR} Penny Mtn. at 6400ft.-Serving the Robson Valley -
b
PMR:VE7PMR} Goodbye.
*** DISCONNECTED [17-04-95 20:09:05]
```

Improvements

In October 1994, after Wayne VE7DUC redesigned an 18-foot, 6-dB commercial Fiberglas antenna for this operation and we acquired two additional 1,000-amp batteries, we had them airlifted to the site. Warren VE7DPG and I hiked up the mountain to install the X1J2 upgrade; the deviation, temperature, and voltage meters; and to open the squelch mode on-line before the snow hit. Otherwise, I would have to wait until late June of 1995 before it thawed enough to get back to the site.

The antenna and battery upgrade were necessary to drop the power to 3 watts and still get the same ERP. PMR also needed the additional capacity to support the new BBS that was now in McBride and all the forwarding it created.

We left the cabin wearing two pairs of long johns, rain clothes, mitts, and snowpacks. We were ready . . . or so we thought. Unfortunately, as we neared the summit the first snowfall of the year hit us with a vengeance. We were now in a full-blown blizzard with 40-mph howling winds and no place to hide, with only 30 feet of visibility! We persevered and mounted the antenna, hooked up the batteries and topped off their water levels, and installed the upgrades. The cordless drill died on us, as NiCds don't like cold; the butane soldering iron also died, as the butane wouldn't turn into gas. We worked around it though, closed the lid, and left without taking a picture. We just wanted to get the hell out of there! We slipped and slid our way down the slope to the cabin through the now 2 inches of snow, our bodies shaking and fingers numb, snow stinging our eyes as it was coming at us at 90 degrees. Hypothermia setting in? This hobby is no fun in those conditions, and I don't think Warren wants to go back to the site anytime soon. I'll stick to August visits myself from now on!

Operation of the PMR since October 1994 has been monitored remotely from the site. The lowest voltage recorded at B4 was 12.3 V, and it was -10° C inside the freezer when the valley temperature was -34° C. The node has been running for more than 5,000 hours on X1J2 software and has never been off the air!

My Gratitude

I thank all the amateurs who helped in this project in various ways, including Shorty VE7HRC and Randy VE7AMS, who were on the initial installation team that put the unit on the mountain, Warren VE7DPG, who almost froze to death with me, and anyone else I might have forgotten to mention.

I believe this project shows that if all amateurs work together, anything is possible. If anyone says to you something can't be done, well . . . remember there is no such thing in life as "can't." PMR is dedicated to God and to my family.

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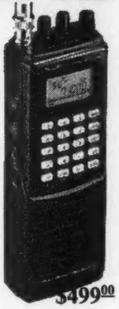
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With the success of America in the next century dependent on our ability to provide high-tech career workers to deal with the information highway and the computerization of the workplace, amateur radio provides a fun way to ger kids interested in learning about technology. It beats the heck out of Nintendo and Sega, which teach nothing. It even beats sports, which provide a good living for a handful of stars and disappointment and poverty for the losers.

We need to see radio clubs sprouting in our secondary and high schools again. We need to see hamming become a major activity in retirement homes and villages. We have room for millions of hams on our bands…of which we're using less than 0.2% today on any regular basis. Yep, that's right, 99.8% of our ham bands are just sitting there almost totally unused, with us waiting around for the FCC to sell them off and pocket the money without even a word of thanks.

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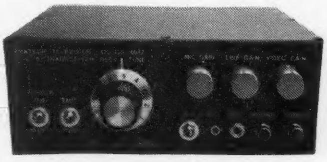

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19,200-Baud Packet

A simple way to do it.

By Alan Dewey, M.S., WB9JTK

Several articles and editorials have expressed the disappointment many amateurs feel regarding the lack of advances in amateur packet radio. When I first tried packet radio in 1987 we had lots of fun at 1,200 baud. Now, eight years later, just about everyone is still operating that same slow speed.

Simply Simplex

Even a 1,200-baud telephone line computer connection is much faster than 1,200-baud packet radio. This is because our 2 meter FM radios are, by necessity of economics, simplex communications devices. The stations at each end of the connection must take turns transmitting information and acknowledging the reception of that information. And when you factor in the frequency usage by others in your LAN (local area network) the effective bits-per-second (throughput) of your "connection" drops to even more pitiful levels. These pitiful rates of throughput further delay acceptance of many of the great uses of packet radio.

So why is all the packet out there running such slow speeds? Well, in order to keep the cost down, the packet terminal node controllers (TNC) that are so readily available, are designed to run on a "standard" VHF/UHF voice FM radio. This means that they will be limited to the available 3,000-Hz bandwidth of most FM communications radios.

Though today we can buy 14,400-bps (bit per second) modems for $89 at the local discount store, that technology is not applicable to amateur radio at this time. Although many manufacturers incorrectly state that their modem is "14,400 baud" it is, in fact, a 14,400-bit-per-second unit. This is accomplished by techniques which rely on the instantaneous phase of the signal having 32 or more possible meanings. If we try these techniques over our VHF/UHF FM radios, we will be very disappointed. Problems such as multipath and signal/noise are much greater "on the air" than on the "twisted pair."

High-Speed Difficulty

You may have heard how difficult it is to get 9,600-bps packet running correctly, that you should use a deviation meter, and often the modification of the radio is not easy. This is because 300-, 1,200-, 2,400-, and 9,600-bps packet systems use audio frequency shift keying (AFSK). Those systems use a "modem" to convert the data into audio signals which then modulate the frequency of the radio. At the receiving end, the discriminator will demodulate the analog frequency modulation of the RF carrier and output an audio signal which the modem then turns back into data. Sound complicated? It is. True FSK eliminates most of this process!

So the easy solution is to use a radio that is designed for the bandwidth appropriate to the speed, and use frequency shift keying of the carrier. It is much more difficult to try to cram a delicate AFSK high-baud signal through a "slow radio." (The Nyquist theorem limits a 3,000-Hz bandwidth channel, whether phone line or radio, to 1,500 baud.) Should we desire to operate packet radio at 19,200 baud, we need approximately 40 kHz bandwidth (for a modulation index of 1.0). On amateur bands 420 MHz and above, the FCC limits on bandwidth are extremely generous, even allowing double-sideband AM television (FSTV) which occupies 9 MHz of the band! And the ARRL bandplan allows for 100-kHz wide "channels" for just such uses as high-speed packet.

Radios for High Speed

Well, finally we are able to buy radios that are designed for the bandwidth required to transmit and receive higher speed packet "off the shelf." WD4NKZ and I have been operating 19,200-baud packet with this equipment for more than two years.

Kantronics introduced the D4-10 radio that was designed with this mode in mind. The radio has the required bandwidth, comes with 430.550 MHz installed and trimmed, and includes digital as well as analog interfaces. When using the "data" port of the radio, the modulation scheme is true FSK with frequency shift of 19,200 Hz total. We only need to mate the radio with a suitable packet controller, antenna, power supply, and coax to achieve our goal.

Our choice is the DRSI PC*Packet adapter type 1. Unlike an external TNC, the DRSI adapter plugs directly into your computer. This allows it to communicate directly to your computer data bus in parallel, 8 bits at a time. Compare this to an external TNC that must communicate with your computer in serial fashion. With an external unit communicating in serial fashion there is an added difficulty for the computer and the TNC in keeping "commands" separate from "data." If, however, your packet adapter is connected directly to the computer bus, you will not have this problem.

The DRSI packet adapter provides the "standard" 1,200-baud modem port, and an additional port settable from 110 to 38,400 baud. This allows us to operate both ports simultaneously, and the speeds are selected independently. Because the 1,200-baud port is operated and connected to your radio much the same way as all other 1,200-baud systems, this article will be confined to set-up and operation of 19,200-baud packet only.

Frequency Shift Keying

First note that for 19,200-baud FSK packet operation there is no modem. This mode uses true frequency shift keying of the RF carrier. This is done by transmitting on one of two distinct frequencies, depending on the instantaneous value of the input data stream. In a perfect world (and with enough receiver bandwidth), the receiver output would represent a nice neat square-wave data stream which could go directly to the packet disassembler. To be practical, the D4-10 includes a data-shaping circuit which makes nice, neat, binary voltages from the received signal. The signal is then directly interfaced to the packet controller. In fact, the interface that I have designed would be unnecessary if Kantronics had in fact built the D4-10 radio as a TTL-compatible unit.

Because the DRSI PC*Packet adapter type 1 can run up to 38,400 baud "out of the box," all that is needed is to convert the voltages from the DRSI packet adapter (RS-232 levels) to the voltage levels compatible with the D4-10 radio. And to allow for unattended operation, we add a time-out timer. (The timer prevents unnecessary interference to other users should your software lock up.)

Should you start to be confused by the remainder of this article, I recommend as good references on packet radio *Your Gateway to Packet Radio* and the *ARRL Handbook*.

What prevents us from plugging the DRSI unit directly into the Kantronics D4-10 radio is that, although the receive data (RXD), transmit data (TXD), and data carrier detect

Continued on page 18

FEEDBACK

In our continuing effort to present the best in amateur radio features and columns, we recognize the need to go directly to the source—you, the reader. Articles and columns are assigned feedback numbers, which appear on each article/column and are also listed here. Please rate each feature or column as "Great," "OK," or "No Way." Mail your responses to: 73 Magazine Feedback, 70 Route 202N, Peterborough, New Hampshire 03458.

1	Never Say Die
2	Letters
3	QRX
4	Tube TNC
5	VE7PMR Solar-Powered Packet Node
6	19,200-Baud Packet
7	RF Speech Processing
8	Working the Final Frontier
9	Single-Chip Identifier
10	Radios, Telephones, and the Amateur
11	Review: Icom Z1A Dual-Band HT
12	Review: Hewlett Packard 200 LX Palmtop Computer
13	Review: Teeny Talkie!
14	A Simple Precision Voltage Standard
15	Transformerless Amplifier
16	The Octopus
17	Ask Kaboom
18	Carr's Corner
19	RTTY
20	Hams with Class
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27	Special Events
28	Barter 'n' Buy
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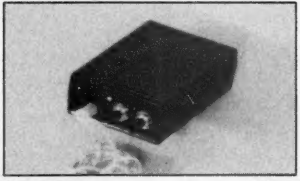

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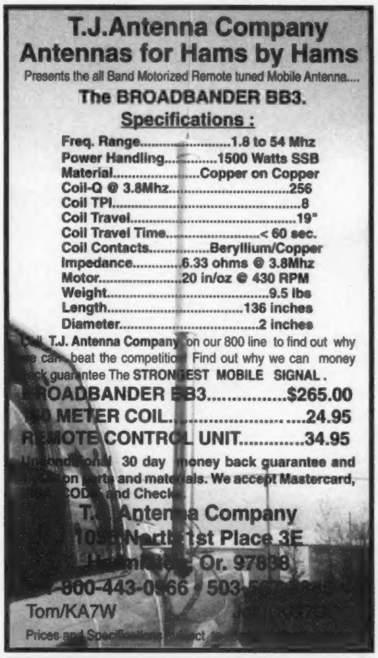

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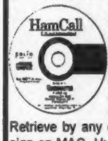

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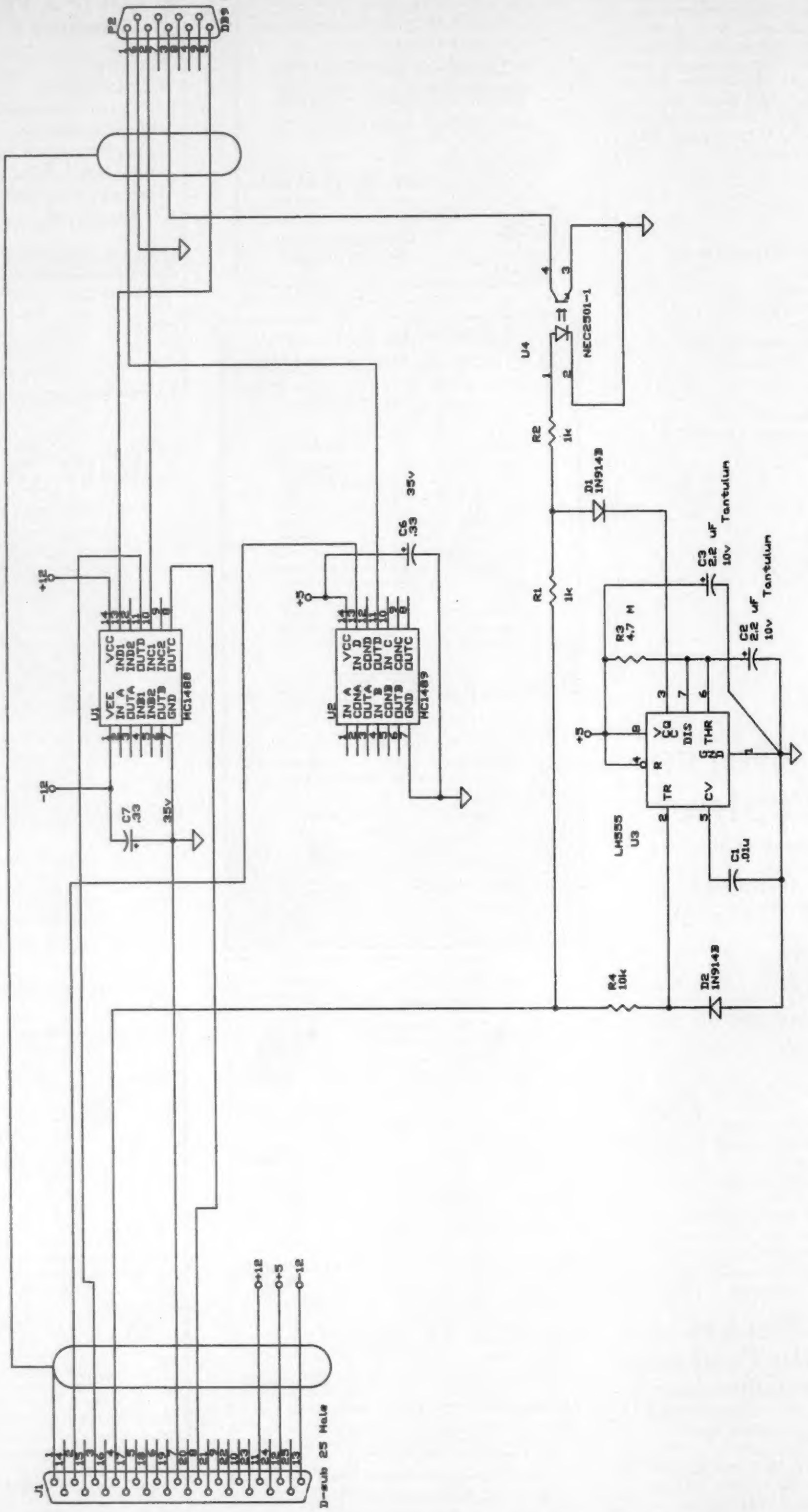
P2
DB9 M
U4
NEC2501-1
R2
1k
D1
1N9143
C3
2.2 uF
10v
Tantulum
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Tantulum
R1
1k
R3
4.7 M
C6
.33
35v
+12
+5
U1
MC1488
VEE
IN A
OUTA
INB1
INB2
OUTB
GND
VCC
IND1
IND2
OUTD
INC1
INC2
OUTC
U2
MC1489
IN A
CONA
OUTA
IN B
CONB
OUTB
GND
VCC
IN D
COND
OUTD
IN C
CONC
OUTC
-12
C7
.33
35v
U3
LM555
R
TR
CV
DIS
THR
GND
C1
.01u
R4
10k
D2
1N9143
+12
+5
-12
J1
D-sub 25 Male

Figure 1. 19,200-baud packet adapter schematic.

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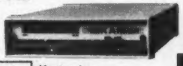

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CIRCLE 41 ON READER SERVICE CARD

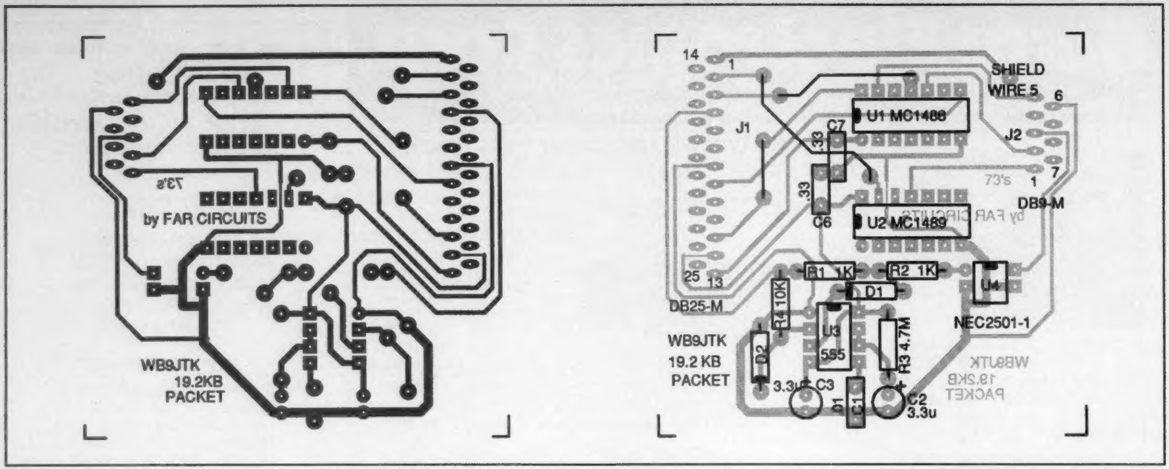

Figure 2. Printed circuit board layout. Pre-made boards are available for $6.00 cash plus $1.50 S&H per order from FAR Circuits, 18N640 Field Ct., Dundee, IL 60118.

(DCD—RF squelch in this case) lines are "TTL compatible" (0 and 5 VDC), the RTS (push-to-talk) line operates with 0- and +12-volt levels! The DRSI PC*Packet adapter can be operated at RS-232 or TTL levels. But neither case is compatible with the PTT line of the D4-10.

I looked at many possibilities to get these two units to work together. Unless we are ready to modify a new radio under warranty, an external solution is required. The method I show here requires no modifications to any purchased item.

Getting It Together

My choice for this solution was to build a small box housing the circuit, a 1-meter cable (the interface is placed near the middle), and the appropriate D-sub connectors. Within the box is one chip to convert RS-232 levels to TTL (signals from the DRSI board to the D4-10), one chip to convert TTL level signals to RS-232 (signals from the D4-10 to the DRSI board), one opto-isolator chip, and an NE555 timer for the 12-volt PTT line of the D4-10.

The accompanying schematic shows how simple the interface is. I built several up on perf-board in an hour. This project does not need to look professional to provide professional results. Placement of components is not important. My interface is built in a plastic box and I have never experienced EMI problems, even during high-power CW HF operation adjacent to my packet system. For those who desire an easier route to a professional looking unit, a kit including circuit board and board-mounted components is available.

The circuit is rather simple. J1 is a 25-pin connector that plugs into the DRSI unit (which is installed in your computer). The 9-pin connector, J2, connects to the radio. Power for the circuitry comes from the DRSI packet adapter itself via three user-installed jumpers. The DRSI manual gives detailed instructions for installation of these jumpers. U1 is a TTL-to-RS-232 converter chip. This chip converts the 0- and 5-volt DCD and RXD signals from the radio to -12/+12-volt levels for the DRSI unit. U2 does the opposite of U1. It converts the -12/+12-volt TXD signal from the DRSI unit to a 0- and 5-volt signal level for the radio.

Next look at U4, R1, and R2. The RTS (request to send) from the DRSI unit is also a -12/+12-volt signal. When RTS is +12 volts, the LED in U4 is turned on, which turns on the transistor, which pulls the PTT line of the radio to ground, which turns on the transmitter. This voltage conversion could be accomplished with a few transistors, but by using an opto-isolator we have a quick solution.

U3 is a common 555 timer. After about six seconds the output of U3 will pull any signal at R1-R2 to ground, which will prevent U4 from keying the transmitter. U3 is reset every time RTS from the DRSI unit returns low. The values shown would allow you to set your PACLEN to about 12,000 bytes, a packet length that would take just over six seconds at 19,200 baud.

A complete parts list is shown in Table 1. Equivalent parts are also available at Radio Shack. Please note that none of the part values are critical, so you may substitute available values that are close. A complete kit, which includes ready-to-use printed circuit board, 1 meter of 8-conductor shielded cable, connectors and connector shells, and all board-mounted components, is available from Solid State Systems, 12807 J West Hillsborough, Tampa, Florida, 33635 for $13.95 plus $2.00 shipping & handling (FL residents add tax on $13.95)

We have built two interfaces which lack U1 and U2. This can be done by changing the DRSI packet adapter to a TTL-compatible unit as shown in the user manual. However, by using the circuit shown, the DRSI unit remains operating with RS-232 voltages so that you can quickly change to 300-baud HF by simply plugging in the HF modem instead of this interface, a move that would not be so easy if the DRSI unit were converted to "TTL" voltages.

Operation

Operating 19,200-baud packet radio with this setup is fairly straightforward. I suggest that those of you that have not used the DRSI PC*Packet Adapter before use the included software, PC-TNC, to start with. Set FRACK to 1 second, RESPTIME to 10 ms, TXDelay to 7 (70 ms), and HBaud to 6 (which corresponds to 19,200 baud). If use of the frequency is light in your area, set PERSIST to 64. These settings should provide immediate results. I recommend that you start in this manner to ensure that the rest of the system is working. You may find some other software that will not work satisfactorily at these speeds. Also, do not attempt to run these speeds under Windows. I know of no one who has been successful.

Once you have tried 19,200-baud packet, you will not find yourself operating 1,200-baud again very often. However, since all DRSI PC*Packet adapters are dual-port devices, you will maintain compatibility with those still on 1,200-baud AFSK by simply connecting the appropriate radio (probably 2 meter FM) to the other port of the adapter. Conversely, with the proper settings of your software, hams with only 1,200-baud equipment can use your dual-port station to make connections with other 19,200-baud packeteers (which now enables you to operate as a multi-frequency node or gateway). The advantages of the higher speeds will become addictive when you discover that you can exchange very large computer files very quickly. With the change in FCC regulations concerning "business" use of amateur radio, it is now legal to exchange shareware programs as well as freeware. Also, these higher speeds will allow remote access to large databases. Things happen so quickly at 19,200 baud that you can only describe it as astonishing.

Great Perfomance for a Few More Bucks

When you compare the cost of 1,200 baud to 19,200 baud you can see that there really is very little difference in price, but a very large difference in performance. And if you compare the total cost (plus work) involved to operate 9,600-baud systems, you will see that 19,200-baud FSK is the clear winner. The

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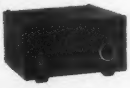
SL-11R	•	•	7	11	2⅝ × 7 × 9¾	12
SL-11S	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R-RA		•	7	11	4¾ × 7 × 9¾	13

RS-L SERIES



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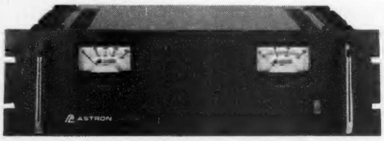
RS-5L	4	5	3½ × 6⅛ × 7¼	7

RM SERIES



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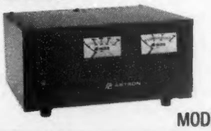
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
RM-60A	50	55	7 × 19 × 12½	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50
RM-60M	50	55	7 × 19 × 12½	60

RS-A SERIES

MODEL RS-7A

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A		•	2.5	3	3 × 4¾ × 5¾	4
RS-4A	•	•	3	4	3¾ × 6½ × 9	5
RS-5A		•	4	5	3½ × 6⅛ × 7¼	7
RS-7A	•	•	5	7	3¾ × 6½ × 9	9
RS-7B	•	•	5	7	4 × 7½ × 10¾	10
RS-10A	•	•	7.5	10	4 × 7½ × 10¾	11
RS-12A	•	•	9	12	4½ × 8 × 9	13
RS-12B		•	9	12	4 × 7½ × 10¾	13
RS-20A	•	•	16	20	5 × 9 × 10½	18
RS-35A	•	•	25	35	5 × 11 × 11	27
RS-50A	•		37	50	6 × 13¾ × 11	46
RS-70A	•		57	70	6 × 13¾ × 12⅛	48

RS-M SERIES



MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46
RS-70M	57	70	6 × 13¾ × 12⅛	48

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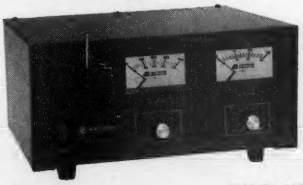

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- Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	Continuous Duty (Amps) @10VDC	Continuous Duty (Amps) @5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

- Built in speaker

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	•	•	5	7	4 × 7½ × 10¾	10
RS-10S	•	•	7.5	10	4 × 7½ × 10¾	12
RS-12S	•	•	9	12	4½ × 8 × 9	13
RS-20S	•	•	16	20	5 × 9 × 10½	18
SL-11S	•	•	7	11	2¾ x 7⅝ x 9¾	12

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

CIRCLE 16 ON READER SERVICE CARD

typical amateur may not be a pioneer in digital communications, but he should certainly not be an antique. If you implement the method shown in this article, you will find that high-speed packet is possible without any exotic test equipment or modification of equipment.

I hope to show to the amateur community that high-speed packet radio is easily accomplished today with very little work. Note that I have not even covered the subject of on-the-fly data compression, which could raise throughput to speeds that will allow for uses of packet radio that are only dreams today. I wonder if, within a year, some ambitious ham might write a TSR which would allow us to play interactive computer games over packet radio. How long will it be before we are operating digital voice networks or voice mail? When the cost of 19,200 baud is compared to 1,200 baud there is no excuse anymore.

Table 1. Bill Of Materials

Item	Quantity	Reference	Part	
1	1	C1	0.01 µF	Digi-Key P4513
2	2	C2, C3	2.2 µF	Digi-Key P2022
3	2	C6, C7	0.33 µF	Digi-Key P2056
4	2	D2, D1	1N914B	Digi-Key 1N914BPH
5	1	J1	DB-25 Male	Digi-Key 225M
6	1	P2	DB-9 Male	Digi-Key 209M
7	2	R2, R1	1 k	Digi-Key 1kQ
8	1	R3	4.7 M	Digi-Key 4.7MQ
9	1	R4	10 k	Digi-Key 10kQ
10	1	U1	MC1488	Digi-Key DS1488N
11	1	U2	MC1489	Digi-Key DS1489N
12	1	U3	NE555N	Digi-Key NE555N
13	1	U4	NEC2501-1	Digi-Key PS2501-1NEC
14	1	3', 8-cond. cable	Carol C0744	Digi-8-Key W408-X
15	1		D-25 hood	Digi-Key 925GM
16	1		D-9 hood	Digi-Key 909GM

Notes

1. Use caution when adjusting the "squelch/DCD" adjustment on the D4-10. Should your "diddle stick" go too far into the unit, the 12-volt supply will be shorted to the 5-volt supply and the transceiver will be definitely damaged. It happened to me.

2. TXDelay. Although the ads say you can run a TXDelay as short as 30 milliseconds, we found that 60 milliseconds is much better. So we run 70 ms to be sure.

3. FRACK. I prefer MSYS BBS software, which only allows setting the FRame ACKnowledge timer in 1-second increments. One second is too long and zero seconds is too short. So, we use 1 second.

4. RF Path. You need a much better RF path for 19,200-baud packet than you do for 1,200-baud packet. At these speeds and these wavelengths, multipath is a real problem. Also, reflection of the RF by trees and plants is much greater than at 2 meters.

5. Software. If you are running a slow computer (8088 or so) and a BBS, you might find that the thing will not be any faster at 19,200 than it is at 1,200.

6. Use TTL port of the D4-10. Set the front panel switches to wide, and the "sat" switch should be off.

7. When you configure your software, be sure that you utilize the DCD feature of the radio. Though some software allows you to use "software DCD," this only adds extra work to your computer and will require longer TXDelays from the transmitting station.

8. It is fun to listen to your 19,200-baud packets "fly" by plugging a speaker into the connector provided on the radio. Do not be surprised that the packets sound like nothing but noise after the initial high-pitched tone during TXDelay. The tone is the result of the non-return-to-zero modulation scheme employed in the AX.25 standard. During the TXDelay, you hear only a single tone, which is the periodic signal that the receiving equipment is using to synchronize the data clock. This is followed by the addressing and data bits, and due to their "random" nature, will result in a signal that contains many different frequencies, hence the noise sound.

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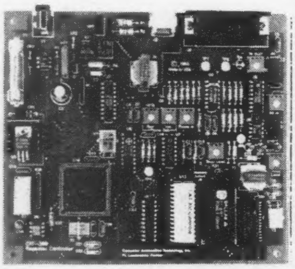

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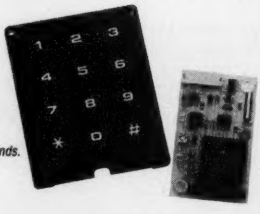

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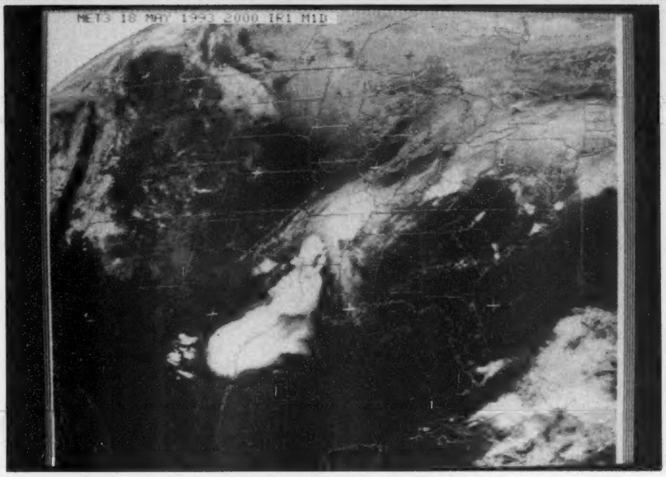

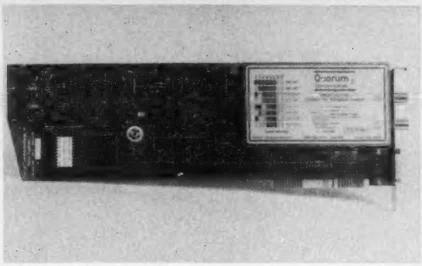

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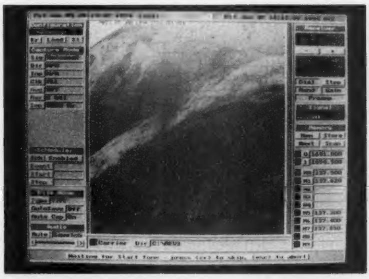

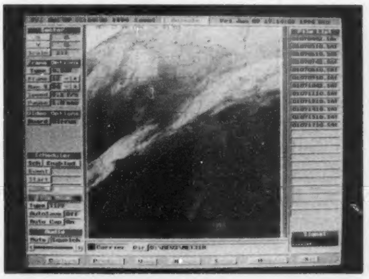

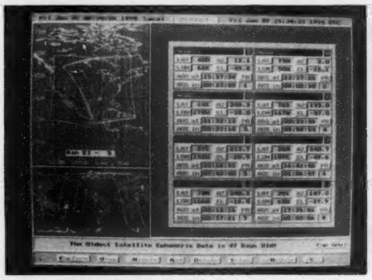

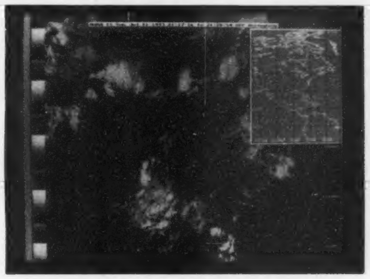

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CIRCLE 257 ON READER SERVICE CARD

RF Speech Processing

How to get an extra 6 to 9 dB of talk power on SSB.

by Greg Whiter VK3CA

It has been verified, through extensive tests, that the ordinary voice contains high-amplitude peaks which are about 14 dB greater[1] than the average level, and furthermore that a large portion of intelligence is contained in the low-amplitude components. It is also recognized that voice communication systems are often peak-power limited. For example, most single-sideband transceivers will output 100 watts of peak power (Peak Envelope Power) before they either flat-top and distort, or their AL systems cut in, even though their average (or *talk power*) output on voice at this time may only be down around 15 to 25 watts. From these facts one infers that the natural voice may not provide maximum utilization of the equipment. Put another way, the talk power is not as great as it could be if the peak-to-average ratio were not so high. If the average can be elevated without overloading on peaks, the weaker components of the voice become more prominent, Figure 1 illustrates this. The result is that on a noisy or cluttered channel, a higher level of *articulation* is achieved.

In order to reduce the peak-to-average ratio, it is necessary to modify the signal waveform. This inevitably leads to distortion of the voice signal. This distortion, in turn, reduces the articulation. From all of this it may be concluded that the best method of speech processing is one that gives the greatest talk power and least distortion. Such a method is RF speech processing.

Which . . . and Why?

In comparing the various methods of speech enhancement we first come to a common form used particularly by the CB fraternity—the so-called "power microphone." The cheaper units found on the market are generally nothing more than microphones with audio amplifiers built in, and provide very little improvement in performance over the radio's standard microphone. In fact, in many cases they will reduce speech articulation by introducing additional distortion and room echo.

The better quality power microphone does incorporate audio amplification, audio peak clipping, and audio filtering. When used correctly it can provide up to 4 dB improvement in articulation (or signal-to-noise ratio) over a standard microphone on a radio that is driven to the point of ALC operation. However, to achieve this, its peak clipping level needs to be up around 20 dB. As an aside, *audio compression alone* can give only about 1 dB improvement in signal-to-noise ratio under these circumstances. On the other hand, a well designed RF speech processor which incorporates compression, RF clipping, and RF filtering can give 8 to 10 dB[2] improvement in received signal articulation when set up to 20 dB of clipping.

One may well ask why there is such a big difference between the performance of audio processing and RF speech processing systems. The main reason for this is that any form of peak signal clipping, by its very nature, introduces distortion products to the waveform. The distortion comes mainly in the form of harmonics generated from the fundamental signal. To maintain the speech articulation at a high level, these harmonics must be removed.

In RF speech processors the unwanted harmonics lie a long way away from the desired signal's frequency and are easily removed using quality RF filters. Unfortunately, in audio clipping systems a number of harmonics lie within the desired audio band and can't simply be removed, leaving the signal with a high level of distortion and consequent reduced articulation.

For example, it is generally recognized that the minimum bandwidth required for an SSB voice communication system is

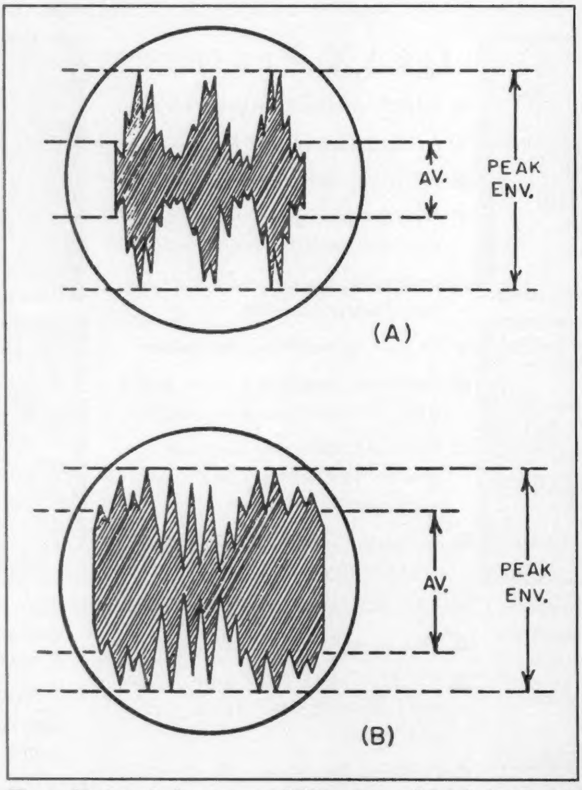

Figure 1A. A typical unprocessed SSB voice-modulated signal might have an RF envelope of the nature shown, where the amplitude is plotted as a function of time.
Figure 1B. The envelope after speech processing shows an increase in average power for the same peak power; that is, a reduction in average-to-peak ratio resulting in better articulation at the receiver.

300 Hz to 2,700 Hz (contrary to this general rule however, most SSB CB radios have bandwidths of 300 Hz to 4,500 Hz). The presence of audio frequencies between 300 Hz and 1,300 Hz are important for good articulation. The second harmonic of 300 Hz is 600 Hz, while that of 1,300 Hz is 2,600 Hz. Both of these frequencies, and those between them, lie within the desired voice band and can't be removed without affecting the desired signal.

Processing, RF-Style

What constitutes a good quality standalone RF speech processor? If an RF speech processor is to perform its task properly, it should contain the following subsections: an audio compressor, a single-sideband generator, an RF peak clipper, an RF bandpass filter, and a product detector. The function of each of these components will be discussed separately below. For additional details, see also the block diagram in Figure 2.

> ***"In comparing the various methods of speech enhancement we first come to a common form used particularly by the CB fraternity—the so-called 'power microphone.' "***

An audio *level compressor* should be incorporated so that the RF stages, particularly the peak clipper, are supplied with a constant average signal level. It has been found in practice that compression in the order of 20 dB is required in this stage.

The *single-sideband generator* follows the audio compressor in order to produce an RF waveform suitable for peak clipping. It consists of a carrier oscillator, balanced modulator, and bandpass filter. The waveform it presents to the peak clipping stage is that of a single-sideband suppressed-carrier signal.

Additional linear RF amplification and amplitude peak clipping are the tasks performed by the *RF peak clipper.* For maximum increase in articulation of the received signal, approximately 20 dB of clipping is required. The waveform after clipping is that of a very distorted signal made up of fundamental frequencies and many high-amplitude harmonics. It is then applied to an *RF bandpass filter* of the same type used in the single-sideband generator stage. The filter output waveform, now virtually free of distortion, is ready to be put to use in the next stage of the RF speech processor.

The final stage, a *product detector,* converts the processed RF signal back to audio frequencies. It consists of a carrier generator (sometimes known as a beat frequency oscillator, or BFO) and a balanced demodulator. Audio output from the product detector, now fully processed, is level-adjusted and available for application to the microphone input of a radio.

Because very high gains are used within an RF speech processor, both in the audio compression and RF clipping stages, the designer must be well aware of the possibility of RF feedback problems occurring. A properly designed unit will have all external connections filtered in an effort to guard against this.

In concluding, if you would like a bigger signal, and your current radio setup is already running at the legal peak power limit, or you just can't afford a big linear amplifier, consider RF speech processing as an option. It is a very appropriate and clean method of increasing power legally for minimum outlay.

For further information, I can be reached at: Greg Whiter VK3CA, c/o GFS Electronics, P.O. Box 97, Mitcham, Victoria, 3132, Australia; 03-873-3777, fax: 03-872-4550. ■

References:

1. Sabin, "RF Clippers for SSB," *QST,* July 1967.
2. Squires & Clegg, "Speech Clipping for SSB," *QST,* July 1964.

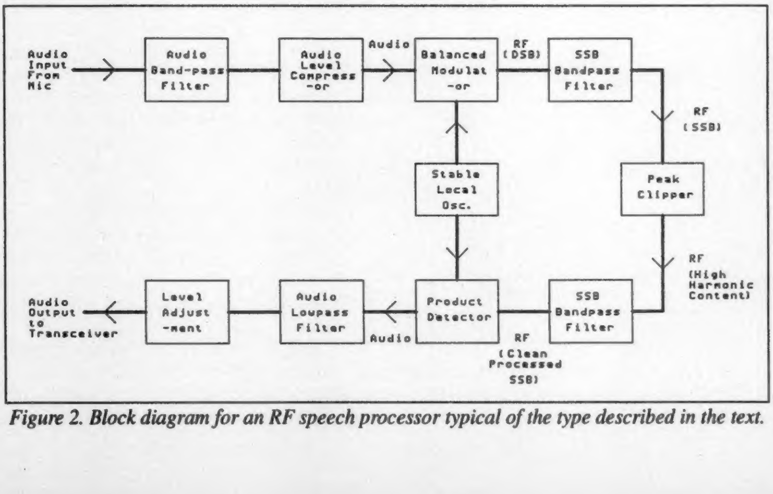

Figure 2. Block diagram for an RF speech processor typical of the type described in the text.

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CIRCLE 194 ON READER SERVICE CARD

Working the Final Frontier

Ideas for a fun and easy ham space program.

by Bill Meara N2CQR/HI8

Here are some ideas on how your average ham, armed only with fairly standard equipment, can get involved with space communications without going over the technological deep end or spending NASA-like megabucks. For the last year or so I've been dabbling in satellite operations. Using ridiculously low-tech gear, I've been surprised by the amount of educational fun that I've had with my little space program; my involvement in amateur space communication has rekindled some of the excitement that I felt as a ten-year-old kid watching the Apollo moon shots on TV.

Getting Started

A sensible first step in a ham space program is acquiring some simple satellite-tracking software. Without an easy, sure-fire method of locating satellites and predicting when they will be within range, trying to work the satellites can be a frustrating experience involving much static and few signals.

The satellite tracking software is essentially a mathematical program that displays on a map of the earth the positions of objects in orbit. The characteristics of the particular orbits are described by what is known as their "Keplerian elements," or "Keps" for short. After you get the satellite-tracking software installed in your computer, you input the Keps (available from a variety of sources) for the satellite you are interested in, and suddenly you have a screen showing the precise locations of satellites of interest. Just tracking the satellites is a lot of fun. I thought it was neat to be able to look at my screen and know that at that moment a satellite was zooming through the night sky over Tokyo!

AMSAT is a great source of satellite-tracking software, and by joining this organization you will be supporting the Amateur Satellite program. For those readers who are not computer experts or who have relatively unsophisticated machines (I use a 286 machine with CGA graphics), something simple like the ORBITS II program will do the trick. You can get the Keps right out of the *AMSAT Journal,* via the packet bulletin boards, or via the online computer networks (I use CompuServe). One tip: Consult the *Amateur Satellite Experimenter's Handbook* from ARRL and learn what the various numbers in the Keps mean. You'll learn a little bit about orbital mechanics, and it will make your satellite ops more meaningful.

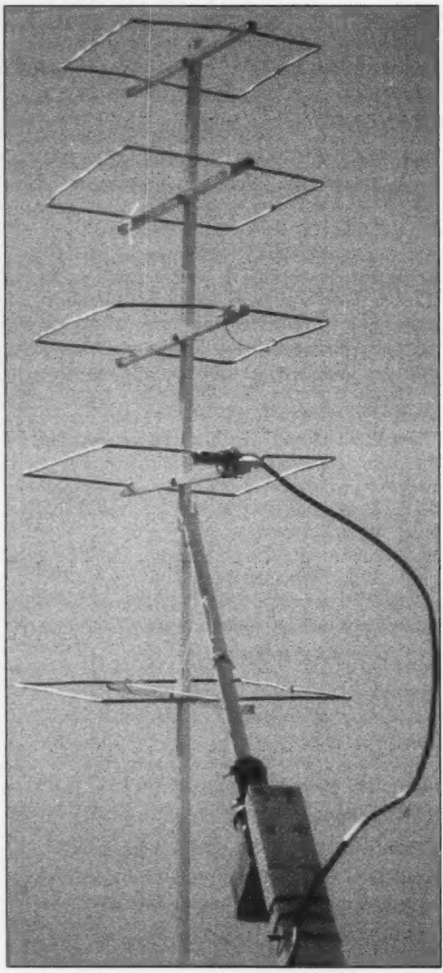

Photo A. The home-brew 5-element quad at N2CQR/HI8, poised for contact with RØMIR aboard Russian Space Station Mir.

One other hint: Make sure you have your computer software clock on the correct UTC date and time. Incorrect settings are a frequent cause for "I can't hear the satellite" complaints. You may be on Eastern Daylight Time, but the bird is on Universal Coordinated Time!

All the old ham literature advises newcomers to spend some time listening before they first try to get on the air, or before they first experiment with a new mode. This is a good idea even in the space age. Before you try to have some QSOs, spend some time trying to listen for the satellites. You'll have a lot of fun picking up signals from space, you'll get more comfortable with the software, and you'll be preparing yourself for that first big satellite contact.

Here are some good candidates for satellite "easy listening":

RS-10/11, RS-12/13 and RS-15: These Russian-made ham satellites put out very strong downlink signals on the 10 meter band. (See the August 1993 and February 1994 editions of *QST* for details on RS-10 and RS-12; see March 1995 *73* for information on RS-15.) You really can't miss these satellites, even if you are using simple wire antennas. When your software shows the bird approaching your horizon, start tuning around the beacon frequencies. You'll hear the CW beacons first. When the beacon is strong, tune through the passband and you'll hear SSB and CW QSOs. Listening tip: Copy the CW telemetry and later consult the *Satellite Experimenter's Handbook* to decode the data (by hand). You'll be able to learn about the satellite's temperature, battery status, power output and other "fun facts"!

DOVE: Here is another good target for "easy listening." Sponsored by Brazilian hams, DOVE is a nine-inch cube that circles the globe, sending out telemetry and messages of international goodwill. At times, DOVE's voice synthesizer is activated and on your 2 meter FM receiver you can hear it say (in English) "Hi! This is Dove in Space!" ("Hi" represents a bit of ham satellite tradition: The first OSCAR transmitted a continuous stream of CW "Hi's.") Unlike other hamsats, DOVE's digital messages are easily copied on an ordinary 2 meter packet station. Here's a trick for capturing signals from DOVE (without losing sleep!): Leave your packet station on overnight with the receiver tuned to 145.825, and leave the computer's storage buffer on. In the morning you're likely to find messages from DOVE on your screen. You can also easily copy DOVE's signal on an HT. Just set your receiver to 145.825; within 12 hours DOVE's packet signals will break squelch.

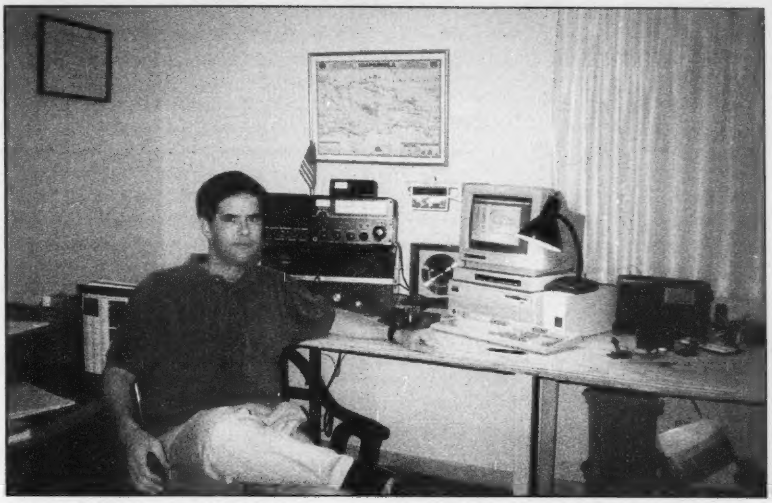

Photo B. See any complicated NASA-type gear here? Nope! Author N2CQR/HI8's satellite ground station is simple . . . but darned effective!

Talk Back!

Once you get the hang of the software and have some listening time under your belt, its time for a QSO! I'd heard that a ham's first satellite QSO is as exciting as his very first contact or first DX; I can confirm that—at least in my case—this is true. I was really amazed the first time I heard my own signal coming back from a spacecraft, and even more excited when I heard someone calling me "through the bird."

RS-10 and RS-12 are excellent vehicles for a ham looking for his or her first satellite contact. RS-15 is in a higher orbit and thus provides better DX opportunities, but the higher orbit might make it a bit more difficult for a newcomer to use.

Don't worry too much about Doppler shift. When I was getting started, the literature sometimes made Doppler shift (the apparent change in frequency caused by the satellite's motion) sound like a formidable obstacle. You will notice the Doppler shift, and it is definitely a force to be reckoned with, but don't get wrapped around the axle trying to calculate how far frequencies will be shifting! Satellite operators are a flexible bunch, and most tune around a little to find the signal of a ham whose signal is being shifted by the forces of physics. I've found that dealing with Doppler is very much like dealing with drifting VFOs in the old days (or dealing with my HT-37 when it's cold).

> ***"I heard one of the astronauts comment, 'We're now passing over the Southern tip of South America.' Eureka! Keplerians confirmed! I felt like I was sitting in mission control!"***

Use RS-10! Because of its easily accessible HF uplink and downlink, RS-12/13 is getting a lot of use, but RS-10/11 is relatively neglected, probably because of its VHF (2 meter) uplink. At the risk of encouraging a lot of chirpy CW, let me repeat a suggestion that allowed me to get on RS-10 with ease: Use a 2 meter FM transceiver for a CW uplink to RS-10. I tried this by simply using the push-to-talk button as a telegraph key, but my signal was so chirpy that I couldn't stand listening to my own signal! In pursuit of a cleaner tone, I opened up my old Yaesu Memorizer transceiver, found the positive collector voltage line going to the driver and final, and inserted a little telegraph key jack. I closed the push-to-talk circuit at the mike jack with a little alligator clip and—presto!—I had a CW signal on 2 meters that allowed me to make plenty of contacts (using a "coathanger ground plane"). The signal isn't the prettiest CW signal on the bands, but I don't think it causes any interference to other amateurs. I found QSOs using this modified rig particularly satisfying: That 2 meter Yaesu FM rig was never intended to work CW DX. Also, doing that little modification made the rig (for me) less of an "appliance"!

This little modification also gave me the capability of working the new RS-15 satellite (2 meters up, 10 meters down) but I haven't had as much success with this bird as I had with RS-10. My modified Yaesu just doesn't seem to get enough signal up to the higher-orbit RS-15.

One of the neatest features of the Russian "Easysats" RS-10/11 and RS-12/13 are their onboard robots. It took me a bit of trying, but I was eventually able to work the robots of both the RS-10/11 and RS-12/13. Some observations: It seems that if more than one station is trying to use the robot at the same time, the machine sort of "locks up." Thus, you might want to wait for a pass in the wee hours of the morning. (From HI8, I just waited for a pass that would have most of the footprint over the relatively unpopulated eastern Caribbean). Also, the robots are looking for 20-wpm CW. They will sometimes tell you to speed up or slow down if you are not at the right speed. You can do it with a straight key, but this is sort of "pushing the envelope." The RS robots are FB hams. They give you a QSO number, say thank you, wish you 73, and QSL (via DF4XW). Talk about "working a new one"!

Moving Higher

After you play with the fast-moving, low-orbit birds for a while, the prospect of finding a satellite that will stay overhead for a long period and will provide the opportunity for real, long-range DX is very appealing. When I added the Keplerian elements for the OSCAR 10 and OSCAR 13 satellites to my ORBITS II program, I was intrigued. Compared to the low-orbit birds mentioned above, these elliptical orbit satellites have enormous footprints and linger overhead for hours as they rise to and fall from their very high apogees. In addition to the prospects for working some interesting terrestrial DX, I was attracted to the possibility of receiving signals from a device 24,000 miles out in space.

I bought a little Hamtronics downconverter to allow me to listen to the 2 meter (SSB and CW) downlink signals from OSCARs 10 and 13 on my old Drake receiver. With these satellites so far out in space, the little "coathanger ground plane" that I'd been using on 2 meters wouldn't provide enough gain. Long-time satellite enthusiast Pericles Perdomo HI8P showed me a June, 1990, edition of *73* magazine that contains an article on an antenna called "The Ray Gun." Using small copper tubing acquired from a refrigerator maintenance shop and some scrap wood from a local lumber yard, I soon had a five-element, 2 meter quad and was listening to OSCAR 10 and OSCAR 13! I kept the antenna at a fixed elevation of about 45 degrees so I didn't have to deal with the additional complication of an elevation rotor. Listening to the DX on these high-orbit birds provides plenty of incentive to build a 70 cm transmit system. The five-element, 2 meter quad also proved very useful as a transmit antenna for RS-10 and RS-15 operations (in lieu of the coathangers!).

Working Manned Spacecraft

The Russian Space Station *Mir* and the U.S. Space Shuttle provide additional challenges for hams who are not satisfied with mere terrestrial contacts. Both the *Mir* and the Shuttle have been active on 2 meter packet and 2 meter FM voice. As you can imagine, competition for contacts is intense, but receiving signals from these spacecraft is easy and at least half the fun of making contact. Here in the Dominican Republic, English doesn't normally come out of my 2 meter FM rig's speaker, but during a recent Shuttle mission Ron Parise WA4SIR broke squelch in Santo Domingo from the Space Shuttle!

> ***"I had one of the most exciting contacts of my life when U.S. astronaut Norm Thagard, aboard the* Mir*, came back to my 2 meter FM call."***

In April of 1995, I had one of the most exciting contacts of my life when U.S. astronaut Norm Thagard, aboard the *Mir*, came back to my 2 meter FM call. Norm is a bit of a "rag chewer," so I was treated to a few minutes of conversation with an astronaut in space!

Unlike all the satellites mentioned earlier, with the manned spacecraft you have to try to update your Keplerian elements frequently. On both the *Mir* and the Shuttle, rockets are fired and orbital characteristics change from time to time; out-of-date Keps could give you false information on the spacecraft location.

During Shuttle missions, the voice communication between the astronauts and the ground controllers is retransmitted on the ham bands by the Goddard Space Center Ham Radio Club (3,860, 7,185, 14,295, 21,395, and 28,650 kHz). When I first started listening for the Shuttle, I wasn't quite sure whether I had loaded the correct Keplerians into my computer. As I was working around the shack, I had my HF receiver tuned to the retransmission frequency, and I had my computer running the satellite tracking program. Just as my computer showed the Shuttle passing over the southern tip of Chile and Argentina, I heard one of the astronauts comment, "We're now passing over the Southern tip of South America." Eureka! Keplerians confirmed! I felt like I was sitting in mission control!

If you really want to feel that you're "in touch" with the Space program, there is yet another use for the tracking software: You can use it to set up an "eyeball contact" with the birds! Both the Shuttle and the *Mir* are big enough and low enough to be seen with the naked eye. Consult your computer for a pass that will have the spacecraft over your horizon within an hour or so after dusk, or before dawn. In this way the spacecraft will be illuminated by sunlight on-high. Armed with your orbital data, you'll know exactly when and where it should appear. I've seen the *Mir*, the Hubble Space Telescope, and various shuttles many times. These big spacecraft are so bright that they are referred to as "flying Venuses" by the satellite tracking community. I don't know if they give out QSLs for signals received in the "visible light" band!

Be careful, because space communication is addictive and is likely to lead you into other closely related and time-consuming pursuits. An astronomical telescope has joined my radio gear in a constant attack on my sleep time. I've also noticed that those enormous Earth-Moon-Earth antennas that once seemed beyond the pale are starting to look interesting and do-able. I'm looking into radio astronomy . . .

Good luck with your space program. The sky's the limit. May the Force be with you. Live long and prosper! ■

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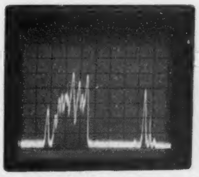

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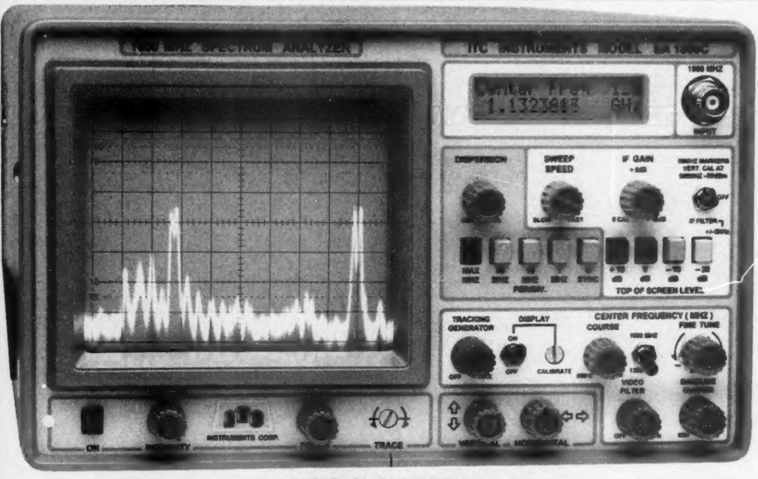
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by Breckinridge S. Smith K4CHE

Here's a very small identifier circuit for your latest miniature fox box, beacon, balloon flight, or basic repeater. It's a *timer and an ID circuit,* all on an economical 18-pin chip, with options for keying outputs, speed, and time. I stumbled upon a CW IDer ad by HCE of Bellefonte, Pennsylvania, and immediately ordered a couple of these chips, with my callsign programmed.

The chip is one-time programmable, so you have to be specific on the exact length and content you want for the identifier message. I chose a message length of 20 seconds for foxhunting, with a series of V's preceding and following my callsign (for example: "V V V K4CHE V V V"). Repeater operations would just have a standard callsign programmed, followed by "/R" and perhaps an abbreviated location, etc. A constant carrier with an identification in the middle is also available. Again, when ordering your chip, be very specific as to content and length.

The programmed IC (Micro Chip PIC16C54RCI) arrived several days later, complete with an external three-pin timing resonator. The schematic shown in Figure 1 was furnished in the instruction sheet from HCE. My contribution was to give suggestions to HCE on additional timing programming, configurations, and adding bypass caps.

Circuit Options

HCE has crammed several options into the chip's 18-pin package. All are selected by activating a high or low on designated pins. CW speeds are 10, 20, 30, and 40 wpm, and use pins 8 and 9. Off-period timing is one, three, 10, and 30 minutes, and uses pins 10 and 11. The standard chip configuration has a push-to-talk output which goes high on pin 6 (PTT) and can be used to key a small 2N222 transistor.

Pin 7 (test) of the circuit supplies a test feature of the identifier, so you don't have to wait for the off-timing period to expire in order to hear the CW tones to adjust audio levels, etc. The identifier transmit "on" period can be of varying lengths, and its timing is separate from the "off" periods, which are four programmed static values and cannot be changed.

When ordering your chips, you must specify if you want an additional keying output available to key your beacon/fox in CW mode. You can have the standard CW audio tones and, if you specify, you can have a TTL keying output which goes high on each code dot and dash segment. When

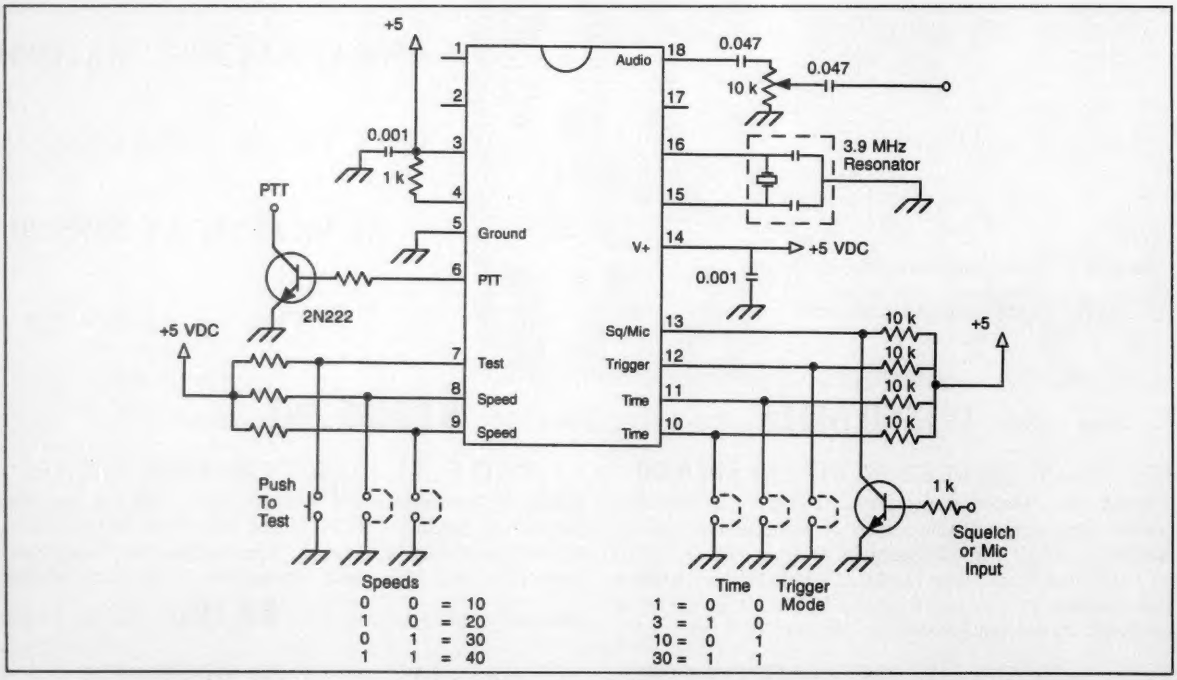

Figure 1. IDer schematic.

ordering your chip, if you choose the TTL keying option you will lose the pin 7 (test) capability, as this port on the chip will be designated as the keyed TTL output. According to Gregg WA3WNE of HCE, pin 7, when configured for a TTL output, can sink quite a bit of current, up to 25 milliamperes, but a keying transistor is recommended.

Construction

During construction, be sure to either ground all selection pins or tie them to +5 volts—don't leave any selections floating. The tiny resonator circuit furnished has three pins: The outside pins are tied to pins 15 and 16 of IC1; the center pin is grounded. The circuit is so simple that I used point-to-point wiring on a Radio Shack circuit board. A really small package can be constructed using "dead bug" mounting of the chip and soldering directly to the pins. As the chip is a CMOS device, use care when handling—ground yourself, etc., prior to handling the chip. However, I did abuse four of these little chips for over a week, letting them roam around my workbench area, and didn't experience any problems with static electricity or anything else.

> ***"During construction, be sure to either ground all selection pins or tie them to +5 volts—don't leave any selections floating."***

During construction I am sure you will try several different configurations on your breadboard, so don't forget to completely power down the chip to allow it to initialize and read its new configuration. As per HCE instructions, you may "tie pins 8 through 12 to ground or +5 volts as needed and eliminate any resistors." As with any logic circuit, regulation of the +5 volts is recommended with a 5-volt regulator chip.

Testing

After wiring the resonator circuit, I found approximately 1 volt peak-to-peak on pin 15, indicating that the clock was running, and the frequency, without any compensation, was approximately 3.987 kHz. My chips from HCE were programmed for a "center frequency of 3.950," to ensure staying within limits when using the 10-minute identification feature. Since the clock runs slightly faster than the "programmed frequency," this makes the one-minute period around 59 seconds. With a 5- to 15-pF variable capacitor connected from pin 15 to ground, I was able to lower the frequency by 10 kHz. However, this cap is not necessary to make the resonator circuit oscillate.

Pin 18 supplies approximately 8 volts peak-to-peak into my high impedance microphone circuit, so the 10k pot may be necessary to adjust the audio levels. One nice thing about the high peak-to-peak audio voltages is that they will easily power a simple varactor modulator circuit.

During repetitious fox box/beacon identification operations, don't forget to tie pin 12 (trigger) of the IC to ground. If you preposition a repeating fox box out with a delay power-on timer, the chip program has no problem starting up from a power-off state and will start its operation first with the "off" period, followed by the identification "on" period, and then start repeating the sequence.

During identification requirements other than a fox box or beacon, squelch gate keying or push-to-talk input keying can be used by tying pin 12 (trigger) high with 5 volts, and using an input on pin 13 (squelch/mike input). Further squelch gate or PTT keying during a brief transmission will not create another ID when using pin 13, as the chip is programmed to start only after the prescribed time period has elapsed. Identification on the beginning of each transmission, regardless of timing, is available by grounding pin 7 (test), leaving pin 12 (trigger) high, and then inputting on pin 13.

Small and Strange

Now you can have a really small low-current fox box package, complete with IDer. Using the TTL output, you can send straight CW, which sounds very strange but is still detectable on FM and provides a challenge to the hunters. The TTL output option for the port on pin 7 is perfect for CW keying of one of WA4ADG's small beacon transmitters (*73*, July 1990 and August 1990). If you want to hear something really strange during your foxhunt, feed audio from pin 18 into the audio input of a small transmitter, and at the same time, key the transmitter on and off CW-style using the TTL option. In the ol' days we called it "modulated CW."

Parts List

Qty.	Part Description
1	PIC16C54RCI (programmed by HCE)
3	1k resistor
7	10k resistor
2	0.001 µF capacitor
2	0.047 µF capacitor
1	10k pot
1	3.9 MHz resonator (furnished by HCE)
1	Push-to-test switch
1	Perf board

Note: The programmed IDer chip and its resonator are available from HCE, 717 N. Allegheny St., Bellefonte, PA 16823. Phone orders: 1-800-544-8450. Price is $11.95 plus $3 S/H.

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CIRCLE 193 ON READER SERVICE CARD

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Radios, Telephones, and the Amateur

Who's the culprit in telephone interference: the RF station or the telephone?

by Glen E. Zook W5UOJ

Virtually every amateur radio operator, at one time or another, has been plagued with telephone interference, either at his own home or at that of a neighbor. With the breakup of the Bell System, and the forthcoming cheap telephones from all directions, the problems of amateur stations (and, for that matter, all sorts of other radio stations) interfering with telephones has become a national problem.

Although not generally known among the amateur radio fraternity, the FCC undertook, over a year ago, an informal study of the problems of interference from radio stations to telephone instruments. The results of this study were released on February 28, 1994, in a document entitled "Telephone Interference Survey." Although not a "scientific" survey in terms of the numbers of complaints and the types of complaints monitored, the results are very enlightening.

For example, the FCC receives about 25,000 complaints a year from individuals who are unable to use their telephones because nearby radio stations interfere with their instruments. Of these complaints, around half are the result of Citizens' Band operations, and the other half are mixed between broadcast and amateur radio operations. Also, it is estimated that this 25,000 figure is only the tip of the iceberg, because the FCC believes that the vast majority of complaints are not reported to that agency.

The FCC Study

In this study, a total of 35 FCC field offices around the country were asked to participate in the survey. Each field office was to select three complaints, at random, and to make the following measurements: station power output, antenna height, antenna gain, and distance from the antenna to the complaining party. In addition, the license type (e.g., amateur) of the station was to be determined. At each location all telephones were disconnected and taken to a chosen telephone jack. Then each telephone was tried while the station was broadcasting. Finally, several commercially available RF filters were tried on the telephones while having the station transmit again.

> ***"As a result of this informal study, the FCC concluded that the telephone, and not the radio broadcasting station, was the cause of the problem."***

When these tests were complete, the FCC personnel connected a "bullet-proof" telephone to the same connection. A "bullet-proof" telephone is one which is designed to be immune from RF interference and manufactured as such by a reputable telephone manufacturer.

During these tests, a total of 108 transmitting stations were checked. These included a mix of the following:

Citizens' Band	47
Amateur	27
AM Broadcast	23
FM Broadcast	10
International Broadcast	1

The power output levels of these stations ranged from around two watts to half a million watts. Over one-third of the transmitting stations were using less than 10 watts, and around one-third were broadcast stations using from 3,000 to 500,000 watts. Thus, the cross-section of power levels was extreme.

A total of 241 telephones were tested at the complainants' residences. Of these, approximately 68% of the instruments had definite interference. Then commercial filters designed for the elimination of RF interference were tried. The first tested was the AT&T Z100B1 model. This filter only eliminated 38% of the interference, with 62% of the telephones tested still receiving interference. Various other manufacturers' filters were tested next. As a group, only 29% of the interference was eliminated, with the remaining 71% still having problems.

Virtually all manufacturers had telephones which fell into both categories. That is, they had models which received interference and those which did not. But a quick look at the list of telephones shows very few models appearing on both lists! For the most part, the telephones which received interference were different models from those which did not.

A total of 16 filters, representing seven model types manufactured by five different companies, did relieve interference in the 16 cases where tried. The FCC states that this is too small a sample to say that they will work in all cases, but they also say that the use of these filters deserves further study. These filters were manufactured by K-Com, Radio Shack, TCE, TEC, and TII.

Both of the "bullet-proof" telephones used in the study were manufactured and modified in the state of Texas. The first type used was modified by Pro Distributors of Lubbock, and was built from a Western Electric Desk Model Touch-Tone telephone. TCE Labs of New Braunfels was the other model tested. The "bullet-proof" telephones were successful in 98% of the cases in eliminating radio frequency interference to the telephone system.

The Fault is in the Phone

As a result of this informal study, the FCC concluded that the telephone, and not the radio broadcasting station, was the cause of the problem. They stated that "manufacturers can design telephones to be interference free."

> ***"The FCC has been aware of these problems for many years, and, if pressed, will take the side of the radio operator."***

As a parallel note regarding the interference problem, the *BiCSi MemberLetter* (May/June, 1994; a newsletter published by the Building Industry Consulting Service International, the primary organization of communications consultants) states:

"The handwriting is on the wall. If our industry doesn't get its act together on this issue, the regulators will. The efforts being made today may not be enough to forestall regulation. As professionals, BICSI members should be aware of this problem and work with our customers to help them resolve their problem."

In addition, the Telecommunications Industry Association (TIA), in cooperation with the FCC, is undertaking a three-part program to help with the interference problem. The first part of this program is a public education effort which has produced a brochure called "What to do if you have interference problems on your telephone from radio, TV stations or other sources." This pamphlet states that if an amateur or Citizens' Band transmitter is causing the problem, the operator will usually be pleased to work with the telephone owner to solve the problem. However, it later states that in the case of radio and TV stations, the operator may not be required to help. The pamphlet goes on to state that the problem is then the responsibility of the telephone owner to solve.

> ***"Be concerned, but be firm! The problem is in the telephone, and not the transmitter!"***

The Station Operator's Obligation, or Not?

Unfortunately, this statement is not directly made concerning the amateur or citizens' band operator as well. But the situation is the same, for the amateur and CB operator are *not* required to take steps to eliminate the problem for the telephone owner. It is safe to say that most operators will make an effort to work with the telephone owner, but assumption of any liability should not be undertaken by any operator.

The second part of this program is to establish the preparation of an RFI immunity specification for telephone terminal equipment. This is definitely necessary in order to provide a benchmark from which the telephone industry can gauge its compliance with the problem.

Finally, the third stage includes a liaison effort among standards organizations to share what is known about RFI and to coordinate an effort to mitigate the problems.

There is a definite problem, especially in the urban and suburban area, with amateur transmitters causing interference to a variety of devices. TVI and HiFi I are also problematical in many locations. Fortunately (in most cases, and unfortunately in a few others), cable TV has contributed to a reduction in TVI from transmitters operating from 160 through 10 meters. Unfortunately, some of the cable channels fall directly within amateur VHF bands, and there is definitely a problem therein. HiFi I is also a problem, especially when the owner of the equipment has spent lots of money for an item that has little, or no, protection from RFI.

The FCC has been aware of these problems for many years, and, if pressed, will take the side of the radio operator. But until the release of the "Telephone Interference Survey" by the FCC, there has been only limited public awareness of the problems. This is a good start! Now when an irate telephone user approaches an amateur radio operator, he/she has a firm basis on which to base the reply. Be concerned, but be firm! The problem is in the telephone, and not the transmitter! Remember, over one-third of the problems happened with transmitters running less than 10 watts out!

If any reader wants a copy of the survey, I will be happy to provide it. Just send $2.00 to cover copying charges, and a 9" x 12" SASE with sufficient postage for four ounces to the *Callbook* address for W5UOJ.

DSP II Filter

CW
SSB
W9GR DSP II
Audio Filter
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ON
PKT
RTTY
MODE
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What is DSP? DSP allows the "construction" of various filters of great complexity by using computer code. This allows us to have easy access to a variety of filters, each perfectly optimized for whatever mode we are operating. The DSP II has been designed to operate in 10 different modes. Four filters are optimized for reducing interference to SSB phone signals from CW, heterodynes and random noise interference. Four more filters operate as "brick-wall" CW bandpass filters. The remaining two filters are designed for reliable recovery of RTTY and HF packet radio information signals. A single front panel switch selects any of these filters. Easy hookup to rigs speaker jack.

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W9GR DSP Filter **$299.95**
12V DC Power Supply..............................**$11.95**

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j-COM SDP-600 SIMPLEX/DUPLEX SMART PATCH
ZETEL

Make and receive phone calls from your mobile rig or handie-talkie with your own personal autopatch. Connection is easy — just hook-up to the mike and speaker jacks on your base station rig and plug into the phone line! Complete control is assured through touch-tone access codes that you set and change at will. Long distance toll access is controlled by special code that you set, preventing fraudulent usage. All programmable codes and set-ups are stored in special non-volatile memory immune to power failures. Repeater owners use the SDP-600 as well for reliable and solid repeater autopatches. Power required is 12 volts DC at 100 MA. Experience the freedom of owning your own autopatch, on you own frequency, to use when and as you wish. The SDP-600 is made in the USA and carries a one year warranty.

SDP-600 Personal Autopatch, fully wired.......**$249.95**
SDPA 12 volt powersupply unit.......................**$11.95**

j•Com Transceiver Control Computer Interface

$54.95

The j•Com Transceiver Control Computer Interface is functionally identical to the **Kenwood IF-232C, Icom CT-17, Yaesu FIF-232C, Ten-Tec 305 and Heath** computer interfaces. It will work with all radios and rig control software which use these interfaces.

- **No external power supply is necessary.** The j•Com TC interfaces require very little power for operation.This power is obtained directly from the computer COMM port.
- **All electronics are enclosed in the shielded DB-25 connector hood.**RFI susceptibility and radiation is reduced.
- **Fully assembled and tested.**
- **Fully Hardware and Software Compatible.** Works with all rig controlled software — Free shareware disk included!

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CIRCLE 55 ON READER SERVICE CARD

73 Review

Number 11 on your Feedback card

by Gordon West WB6NOA

Icom America, Inc.
2380 116th Ave. NE
Bellevue, WA 98004
IC-Z1A
Price class: $715.00

Icom Z1A Dual-Band HT

It's definitely different!

Icom America calls their new dual-band IC-Z1A hand-held transceiver "the next generation." Amateur radio operators taking part in this review labeled the Z1A as "definitely different" with its detachable front panel that turns into a tethered, back-lit remote operating system. And everyone agreed that wearing the remote mike/control panel on your jacket collar turned many heads at local hamfests and ham club meetings.

The Icom America IC-Z1A is a $500+ dual-band handheld that is shipped with the remote microphone/control system, including the black curly cord. In other words, its most unique feature is not something that you'll need to spend some extra bucks on; it's all ready to go, transforming itself into a regular dual-band handheld with a front face that clicks out and attaches to the top of the unit via supplied rubber mike cord. The Z1A is also shipped with a battery pack that has absolutely no cells on the inside! This is actually a feature: The alkaline battery pack that comes with this set accepts four common AA alkaline cells that are available everywhere. You can therefore get on the air with your new unit as soon as you pop in the four cells. With other transceivers, it's a few hours' wait until the rechargeables come up to speed before you can begin operating your new set.

Step-up HTs and the Z1A Difference

The Icom Z1A would be considered an advanced-operating radio for seasoned hams who have outgrown their present HT radio system. It might be considered similar to the following step-up HTs:

Alinco DJ-G5T
Kenwood TH-79A
Standard C528A
Yaesu FT-51R

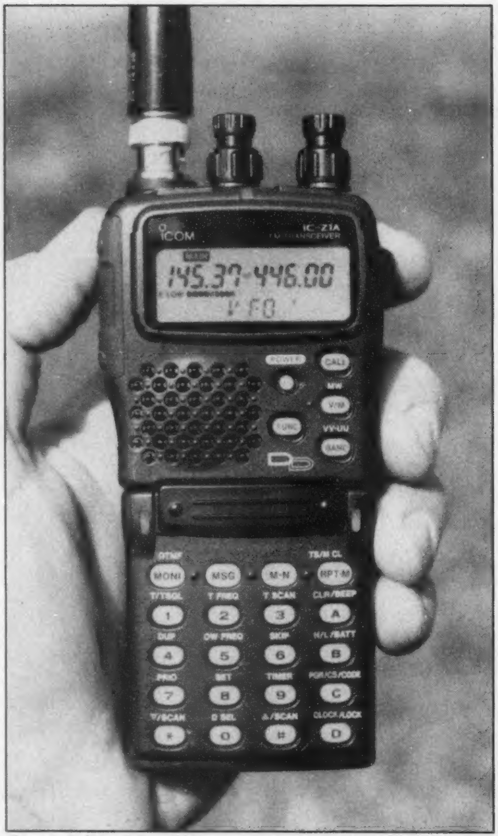

Photo A. The Icom Z1A ran all day on the supplied dry-cell battery pack holder.

What Icom did in the design of the Z1A was to take the remote mike capabilities a few steps further than the popular Yaesu MH-29A2B display microphone. The Icom remote mike is actually the integral display and control head that fits right on the HT itself, and quickly remotes out on the coiled black mike cord. The switchover takes less than five seconds, with seven gold-plated pins picking up the connection points. Just remember where you stash the OPC-500 remote display holder, because this is the key feature that makes this handheld so unique in this price category. And keep in mind that the remote display system is included in the original price of the unit, unlike the optional remote mikes from the other manufacturers, including the display microphone from Yaesu that is sold separately.

During our review, we learned the programming techniques with the control head fixed right on the unit. This way we could hold the equipment with one hand, and be able to get at both the display control head as well as the keypad that stays on the body of the unit.

"During the design process of this equipment, there was consideration given to putting the entire keypad on the back side of the remote control head," comments Icom America. "But our research team made up of avid ham operators concluded that the remote control head with its curly cord did not need the keypad on the back side, because this would lead to additional unnecessary weight and the possibility of accidentally pushing a wrong button while talking into the microphone control head." And we agree. The detachable control head features a large LCD display that is extremely visible at all angles, alphanumeric readouts, up-and-down channel-changing buttons, and a couple of other buttons to quickly recall and memorize displayed frequencies in either VFO or MEMO mode. The built-in speaker on the detachable control head is adjusted via a volume push-button, and push-to-talk plus a nightlight are conveniently located where you would expect them to be: on the edge of the detachable remote head. And when you snap

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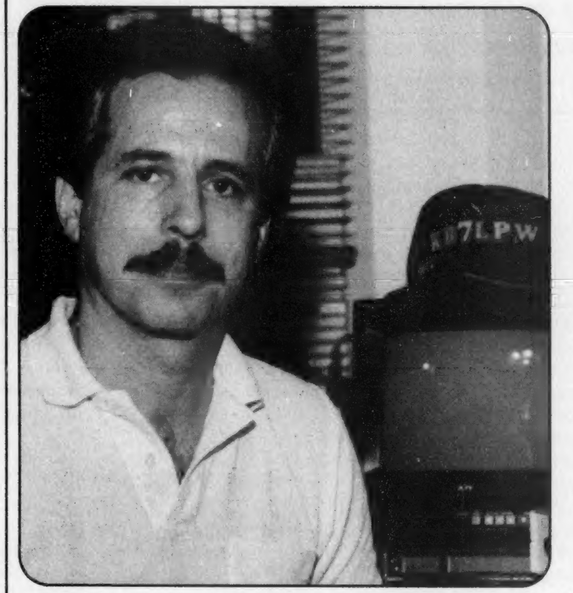

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IL:	WKEI	1450 am	KEWANEE
IN:	WPDJ	1300 am	HUNTINGTON
IO:	WKEI	1450 am	DAVENPORT
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MA:		BOSTON CABLE CHANNEL 38B	
MI:	WMKT	1270 am	TRAVERSE CITY/CADILLAC
MO:	WBGZ	1570 am	ST. LOUIS
MO:	KSLQ	1350 am	WASHINGTON
MO:	KNWA	1600 am	SPRINGFIELD
NC:	WCRY	1460 am	RALEIGH
NC:	WEEB	990 am	FAYETTEVILLE
NC:	WSKY	1230 am	GREENVILE/SPARTENBURG
NE:	KICS	1550 am	LINCOLN
NM:	KICA	980 am	AMARILLO
OH:	WIOI	1010 am	CHARLESTON/HUNTINGTON/ NEW BOSTON
OK:	KADS	1240 am	OKLAHOMA CITY
OK:	KTMC	1400 am	MCALESTER
OR:	kbnp	1410	PORTLAND
PA:	WJMW	550 am	SCRANTON/WILKES BARRE
SC:	WPCC	1410 am	CLINTON
	WJMX	970	MYRTLE BEACH/FLORENCE
	WDAR	1350	DARLINGTON
TN:	WRWB	740 am	KNOXVILLE
TX:	KIVY	1290 am	CROCKET/PADDINGTON
UT:	KTKK	630 am	SALT LAKE CITY
UT:	K26EM	CHANNEL 26TV	EMERY COUNTY/ CASTELEDALE
VT:	WSYB	1380 am	RUTLAND
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the detachable head back onto the body of the unit, the buttons are exactly where you would want them to be if you weren't running the unit off of the coiled cord.

Turning It On the First Time

Before turning on the unit for the first time, we double-checked that we put in the alkaline batteries with the right polarity, slipped on the skinny, flexible dual-band antenna, and added the belt clip that doubles as the heat sink during prolonged TX contacts. We also attached the hand strap that I always like to curl around my little finger when operating the set in case something happens and it begins a downward plunge to the deck.

> ***"A quick push of the VOL button at the top of the remote unit allows you to adjust the volume of each band from the top knob."***

We tried the detachable control panel, and it slipped on and off while pushing the release buttons upward. The book says to be sure and do this with the power turned off, but during our test we tried it with the power on and there were no adverse results. We could even do it in the dark, aligning the connectors on the bottom of the dummy panel end of the OPC-500 and then clicking the top of the panel into place.

This panel wobbled slightly when snapped into place. This would be expected since it's a plastic-to-plastic fit with a spring-release mechanism on the outside tabs. We would have liked to see some sort of a little rubber O-ring for a more positive and tight fit. The slight wobble on the front panel was quite evident on transmit when we were exchanging reports with other stations. Since the push-to-talk is on the detachable part of the control head that slightly wobbles on the unit, we heard a slight grating sound on TX.

Bob Gregg AB6CH came up with the relatively simple cure of placing a thin foam pad between the two connected parts that gave us just enough pressure to keep the wobble down to no-wiggle, and the TX problem cured itself with everything on nice and tight.

Power-on is a small power button next to the speaker on the remote panel. The button has a relatively long play, which we judged to be a distinct advantage. Unless you really get your finger on it and push it all the way down, the unit does not accidentally get turned on or off. This is a big improvement over other transceivers we have tested that accidentally get switched on or off when you stick them in your pocket. You must depress this power button all the way in before the unit beeps and turns on.

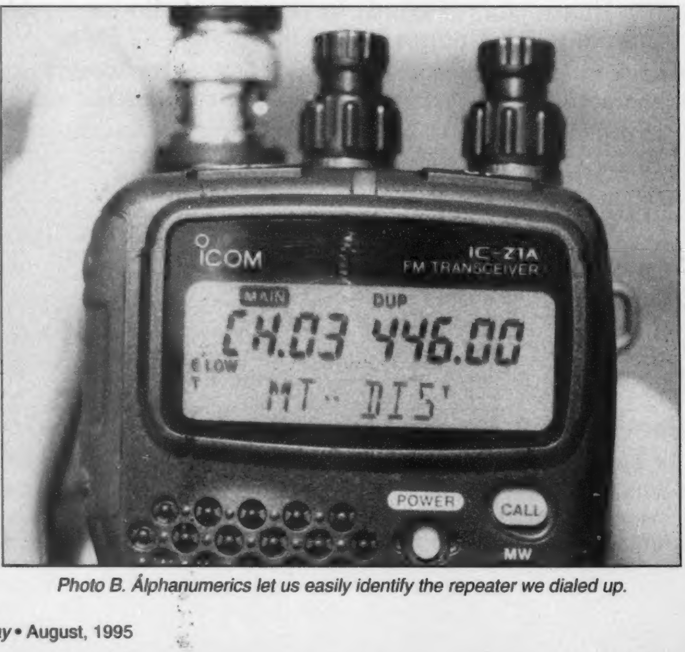

Photo B. Alphanumerics let us easily identify the repeater we dialed up.

The unit powers up on 146 and 440 MHz like all "brain-dead" mobile and hand-held dual-band transceivers do. It's hard to believe that, with today's radio cloning and CPU-loading technology, all manufacturer dual-band hand-held and mobile units have nothing in the memory, not even the "top 20" repeater pairs compiled by the American Radio Relay League as the most common channels throughout the country. While it's good for all new hams to learn how to program their handhelds from scratch, a few pre-memorized frequencies that would come up on initial turn-on seems absolutely logical to me so you can begin hearing some activity as you're reading over the manual and beginning to learn how to start the programming sequence.

Can you imagine buying a new stereo color television and, when you first turn it on, finding that you have to program the video frequencies and the audio frequencies into each and every channel for VHF, UHF, and cable? I know this sounds ridiculous, but why not have a handheld that powers up with the nation's most common repeater frequencies in memory, and even a few out-of-band national weather frequencies, too?

The unit powers up in the VFO mode, since there is nothing in memory. To change a frequency or to activate a function, you must first decide whether you want to play on VHF or UHF as the main band. Push the little band switch and watch it toggle between VHF or UHF with the word "main" appearing above the band that you have selected.

You can then change frequencies by turning what you might expect to be the volume control on the top of either the VHF or the UHF knobs, or pushing the up or down buttons, or punching in frequencies using the keypad on the bottom body of the HT. So where is the volume control? It's where you would expect it to be, on the top of each one of the knobs. A quick push of the VOL button at the top of the remote unit allows you to adjust the volume of each band from the top knob. The display registers between zero and 16 as you adjust the volume. When, after a few seconds, the radio sees no further volume change, the top knobs revert back to their channel changing function. We have seen this in other brands of transceivers; and after you get used to the procedure, it presents no problem. But when you first start using the unit, you might reach for the top knob to turn up or down the volume, and realize you have changed VFO frequencies or memory channels. Maybe in the SET mode there is a way of permanently setting the volume to the top of the two little knobs after you have preselected the VFO or memory modes. But then you wouldn't be able to change channels. I'll do some more thinking on this subject before I decide whether I can get used to this "feature" that many hams say they have mastered in no time at all! As I indicated at the beginning of the article, this is an advanced-function transceiver.

Receiver: Sensitive, Selective, and Pretty Immune

After a few days of running the unit in the VFO mode, and the relatively simple memory process, we wanted some first impressions on the receiver section. Was it sensitive? Yes. Was it selective? Yes. Was it immune from intermod and desense from nearby strong stations off frequency? As good as the rest. When compared to other hand-held transceivers in this price class, the Z1A possesses almost identical sensitivity, selectivity, audio output, intermod rejection, and great receiver performance. While we did perform receiver and transmitter tests on an IFR service monitor, we felt the best test was to take the unit into a downtown area where inexpensive handhelds will begin to desense and break squelch on out-of-band signals. The Icom Z1A has a terrific receiver, and in the downtown "intermod alley," the unit performed exceptionally well on an outside dual-band an-

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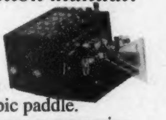

***MenuDriven* Memory Keyer™** in a compact package mounted on a Bencher iambic paddle. Store 192 characters in 4 message memories. Morse trainer, sidetone, automatic serial numbering plus all the features of MFJ-492 except remote control jack and extra memory. **MFJ-490X, $109.95,** keyer only, no paddle.

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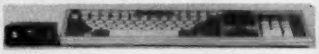

Stand alone CW Keyboard includes AT type keyboard, 200 character type-ahead buffer, two 100 character nonvolatile message memories, more. **MFJ-451X, $79.95,** keyboard interface only.

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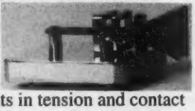

MFJ Deluxe Iambic Paddle features full range of adjustments in tension and contact spacing, self-adjusting nylon and steel needle bearings, contact points that almost never need cleaning, precision machined frame and non-skid feet on heavy chrome base. For all keyers.

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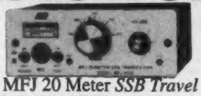

Take this *tiny* MFJ 20 Meter *SSB Travel Radio*™ with you and enjoy DXing and ragchewing wherever you go.

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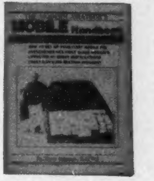

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Packet Radio is Made Easy by Buck Rogers K4ABT. Makes packet easy! How to set up, digipeating, mailbox, more. MFJ-32, $9.95.

Easy-Up Antennas by W3FQJ. Gives you inexpensive, easy to build antennas for virtually every SWL or ham need. MFJ-38, $16.95.

Troubleshooting Antennas and Feedlines by W1TF. How to troubleshoot and get your antenna system performing. MFJ-3301, $12.95.

***73 Dipole and Long-Wire Antennas*•.** 8 chapters, 7 appendices. MFJ-3302, $12.95.

***73 Vertical, Beams and Triangle Antennas*•.** All built and tested by W3FQJ. MFJ-3303, $12.95.

Oscar Satellite Revue by K4TWJ. How to set up a satellite station. Quick Start guide, tracking data and equipment review included. MFJ-31, $7.95.

The Shortwave Listener's Guide for Apartment/Condo Dwellers by W3FQJ. Key to *indoor* SWLing and DXing. MFJ-36, $9.95.

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The Wonderful World of Ham Radio: An Introduction for Young People by Richard Skolnik KB4LCS. MFJ-35, $7.95

Ham Radio Communications Circuit Files by W3FQJ. 61 bipolar transistor, FET and linear integrated circuits. MFJ-37, $9.95.

***Solid State QRP Projects*•.** 52 QRP projects in 8 chapters. MFJ-3502, $12.95.

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CIRCLE 86 ON READER SERVICE CARD

tenna, with little sign of receiver wipeout from the saturation of incoming radio signals on a Friday afternoon. We also found that the extremely small speaker that is part of the detachable head did an amazing job of giving us great audio when the unit is worn joined together on the belt. And when you detach the control head and run the unit from your jacket collar, you have audio to spare!

> ***"These functions are cherished by savvy repeater control ops who regularly control their repeaters on UHF using a multifunction handheld."***

On transmit, the unit ran relatively cool on our alkaline battery pack. When putting on a higher voltage rechargeable battery pack, or running the unit at 13.5 volts DC from the optional power cord, we saw up to 6 watts of power output on high power, a half a watt on low power, and 15 milliwatts on extremely low power which did an amazing job with working nearby repeaters. The unit automatically powers down to this extremely low power 15 milliwatts when the set detects low rechargeables or low alkaline batteries. This function can be turned on or off in the SET mode.

When operating through repeaters, we dialed up subaudible tone, and found the usual 33 CTCSS available and built in. Just about gone are the days in which you need to buy and install a separate tone encoder. However, we were disappointed not to see a built-in tone decode module as part of this package. Tone decode requires you to order the $50 UT-93 tone squelch unit that also gives you some pocket beep and page alert functions that only about one percent of hams in the United States ever use. However, most hams who operate CTCSS would certainly enjoy full decode capabilities in order to run with other units using the same tone on a simplex basis for quieter operation. The UT-93 slips under the battery compartment tray after you have carefully removed six screws and separated the front and rear panels as described in the instruction manual. If you're not into dissection, let a pal who does this every day give it a try. It just plugs in, and you wonder why the factory didn't already plug it in and charge you a few bucks more for the entire package, anyway.

We liked the auto-repeater function, where the unit in VFO automatically selects 600 kHz down or up, or 5 MHz down or up, as you go through the band. You can turn this on or off in the SET mode when you first program your handheld. And if you're looking for repeater activity, just hit the scan button, and away it goes until it locks onto an active frequency.

Memories

The transceiver has 46 memory channels, plus 3 pairs of scan-edge channels on each band for storage of often-used frequencies. Each memory channel can hold operating receive frequency, duplex up or down or simplex, subaudible tone encode, scan-skip or scan-hold, and best of all, memory channel names. It takes a few minutes of book reading (and we did like the all-English instruction manual) to learn how to select the letters or numbers for the memory name ID. Once you get rolling with the operation, it takes about 30 seconds to name each channel. If there is nothing for a name on a memorized channel, it comes up as "NON AME."

And like all dual-band handhelds, you have a call channel, five different types of scanning, memory scanning and individual memory skip, scan resume times, priority watch, and quick swaps of memory channels to VFO. These functions are cherished by savvy repeater control ops who regularly control their repeaters on UHF using a multifunction handheld. If you're not into this type of operation, it's nice to know the unit has the capabilities, and the Z1A does.

And it has a clock. After one week, it lost only 20 seconds. We did discover that the clock is powered by an internal rechargeable lithium battery when the main battery pack is detached or exhausted. If you don't have a fresh battery in your unit, the clock goes whacko after about a week, and you'll need to reset it after the built-in internal rechargeable lithium battery comes up to speed. We were worried that the clock might affect what was stored in memory, but it appears that this is not a problem. The memory stays put, even with the regular battery pack out of the unit.

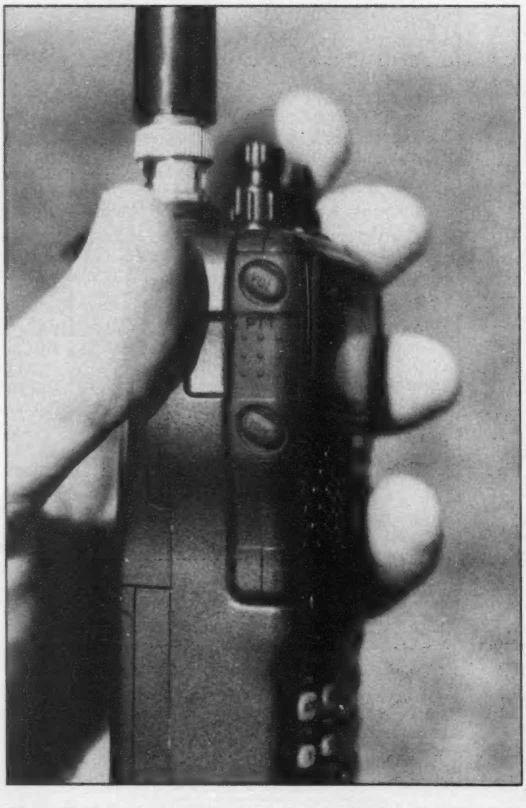


Photo C. You can see where the head detaches from the Z1A body.

Part of the clock circuit is a timer unit that can turn your set on and, better yet, turn it off automatically if you forget and leave it on. You can preset the automatic off function at 60 minutes, 40 minutes, or 20 minutes.

If you make a lot of autopatch calls, there is a six-memory DTMF storage for up to 30 digits in each slot.

Doing DTMF with Memory

To transmit a DTMF code, first select the memorized channel, dial up the DTMF memory number-sequence you want to send out, push PTT once to exit the DTMF memory mode, and then push PTT at the same time as the MONI button to transmit the selected DTMF code. And when you're first setting up this mode, make sure your repeater will accept the speed of the outgoing DTMF number string; if for some reason the repeater doesn't react fast enough, you can choose any one of four DTMF speeds to coincide with your system. A SET mode speed selection allows for a 100 millisecond-, 200 millisecond-, 300 millisecond- , and very slow 500 millisecond-sending of the characters. It goes from five characters per second all the way down to one character per second.

Another feature we discovered with the Icom Z1A was cross-band full-duplex and cross-band repeat capabilities. This allows you to listen on one band and transmit on another—either manually or automatically. And while this is relatively common in most handhelds, I must mention that this mode should not be engaged when in high power. For unattended cross-band repeater mode, a long-winded operator could actually cause the handheld to burn up if it is running on an external 13.5-volt power source. Your handheld is not intended to be a repeater; so use the cross-band duplex and cross-band repeat only in low power.

And speaking of low power, it's nice to know how much battery life you have left after you have been operating for a few minutes or hours on the air. You enable a battery voltage indication by first pushing

FUNCTION, and then BATT to indicate voltage from 4.5 volts to 15.5 volts with 1/2-volt increments. This is a great way to spot an alkaline pack beginning to die out, and also a great way to double-check that a rechargeable pack doesn't have a bad cell. With alkaline packs, you'll see the battery voltage slowly begin to decay as the battery pack delivers power. However, with rechargeable batteries, the battery voltage indicator does not tell you how much life you have left. This is because rechargeables go until the very end, holding their own, and then drop within one minute from a normal state to "DOA." So plan to use the battery voltage indicator when running from an external voltage source, or running your set on alkalines in that four-cell alkaline holder that comes as part of the original package.

Photo D. The head detaches by moving the release buttons up.

SET Mode Features

We found some interesting features in the SET mode that really went along well with the detachable control head setup. One nice selection was the LCD contrast as well as lighting selection. When you run the remote head on your collar, it's helpful to have just the right amount of back lighting, as well as the right type of contrast on the LCD's display. We were extremely impressed with the LCD display because it could be seen at all angles. Some LCDs on other handhelds tend to negate the capability of seeing it when looking down on the display. On the Z1A, you could look at it from any angle and see it clearly.

The SET mode also allowed us to lock out the keypad that stays as part of the body when worn on your belt. We then discovered that there indeed was a way to set the volume switch that holds on the top knob. In fact, in the SET mode the volume switch can hold, push for volume, and then automatically cycle back in a 5-second audio mode. There were several other things that you could change when it came to CPU behavior in the SET mode, but what we were most interested in was how usable was the remote head when worn on a jacket or on a shirt lapel. *Very* usable, thanks to the layout of the buttons.

We liked the fact that you could go between VFO and memory mode without having to take the unit off your belt. It was also nice to be able to see the LCD memory channel display just by taking a glance at it over your shoulder. Plenty of audio, and great-sounding transmit on the detachable head.

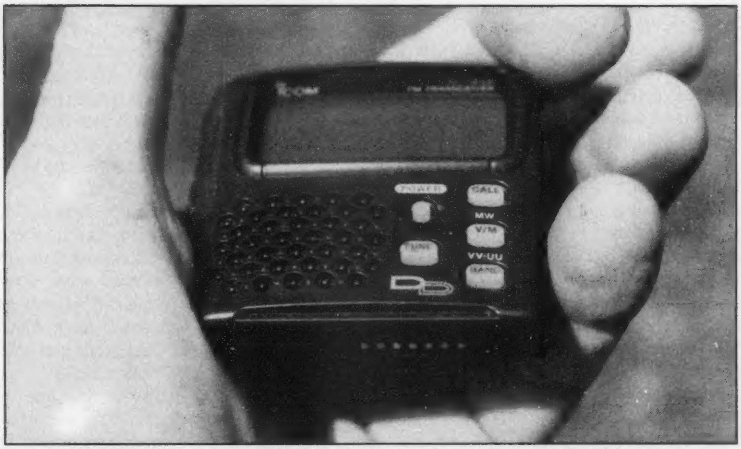


Photo E. Gold contacts on the detachable head make for a good, solid contact.

"How about putting the antenna on the remote detachable head?" comments Roy Stephens AC6CQ, one of our evaluators of the Icom Z1A. Interesting idea, similar to that of Motorola equipment that public safety officers wear with the antenna at a much better spot than at belt level. Icom indicates it might consider this for new equipment coming up over the next few years, but for this set the antenna circuit is on the body of the unit and not the head. But they did indicate that simple antenna adapters are available that plug into the BNC jack and clip to a helmet or baseball cap, and with one additional tiny wire (coaxial), you have the same effect. They also point out that jacks are available on the top of the unit for conventional speaker/microphone assemblies when you run the unit with the detachable control head still on the body.

We judged the contents of the instruction manual to be of exceptional quality. Written in polished English, with all aspects of the Z1A well-documented, it includes a functionality diagram of the button-pushing process, as well as a small abridged cheat-sheet that you carry with you in case you need to do something that you forgot a few days earlier.

We were surprised to hear this unit does not clone. Too bad—it's time-consuming to duplicate all of the memory channel information and alphanumerics from one unit to another without the cloning feature. Icom says cloning is in the future, but not with the Z1A.

Conclusions

Is the Z1A for beginners? Certainly so—and as you grow into the radio, you can begin to use many of the advanced features that are detailed well in the manual. But if you have already mastered your present dual-band handheld, and you're looking for more in the control head/mike, this has got it! It's also quite a potent conversation piece when people spot the body of the unit on your belt, and the control head/mike up on your shoulder with terrific-sounding receive audio.

The unit also tunes out-of-band frequencies, including aeronautical, and this we come to expect with any good dual-band handheld in this price range. We ran it for several weeks on a fresh set of alkaline cells, and the unique battery-saver circuit that cuts current down to as low as 32 milliamps gave us plenty of time on the pack before we needed to substitute fresh cells.

We think Icom has another versatile advanced-feature handheld that is great for both beginners as well as those operators wanting the ultimate dual-band HT. The focus groups who helped shape this new unit electronically did an excellent job, and Icom America always welcomes suggestions on what they can do next to top some exciting products that they are presently marketing. Don't forget the foam rubber behind the control head to quiet the rattle, and you'll be all set with one unique dual-band, detachable-head handheld.

73 Review

Number 12 on your Feedback card

by Gary Sargent KE8WO

Hewlett Packard Company
Direct Marketing Organization
Box 58059 Mail Stop 511-L
Santa Clara, CA 95051-8059
Phone: (800)-752-0900
Price Class: HP 200-LX $549 (w/1MB RAM))
$699 (w/2MB RAM)

Hewlett Packard 200LX Palmtop Computer

What, another computer? Try this one on for size.

There are far more computer manufacturers than Heinz has varieties! Since they are all pretty much the same, why in the world is one being reviewed in these pages? The Hewlett Packard 200LX is unique and has significant features that will interest the amateur radio community.

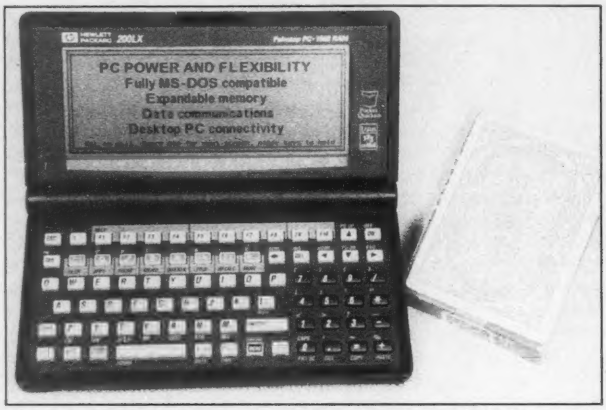


Photo A. The usefulness of the Hewlett Packard 200LX is greatly enhanced by it's being pocket-sized.

Smaller is Better!

The key to the value of the HP 200LX is its size and its built-in programs. Like HTs, camcorders, cellular phones, and other electronic gizmos, think of how useful your HT would be if it were still the size of a Heathkit lunchbox 2 meter rig. Not very. A pocket-sized device provides utility and convenience that magnifies its other features.

So it is with the HP 200LX. The 200LX is a PC XT compatible computer that fits in your shirt pocket! Imagine a full-featured PC that is 6.3" x 3.4" x 1" and weighs a mere 11 ounces. Add this extremely small size to its extensive collection of built-in programs and you have a very useful device.

Big on Features

The 200LX is an IBM PC/XT-compatible computer operating at 8 MHz, a DOS-based machine that is not intended to run Windows and associated RAM- and CPU-intensive programs. By modern standards, an XT computer will not knock your socks off, but its computing performance is entirely sufficient for the unit's built-in programs and the tasks for which it's designed.

The 200LX features a full, albeit small, keyboard with the familiar QWERTY layout. The 82 keys include ten function keys, eight dedicated application keys, inverted "T" cursor control keys and a numeric keypad. The keys have a good feel and are very much like a calculator, which makes sense since HP's calculator division designed and manufactures the 200LX. The keyboard is quite small and does not lend itself to typing-intensive activities. If your hands and fingers are of average dexterity, you will have no problem with the keyboard for light to moderate use. You should try the unit before buying, to insure you can live with the keyboard. I managed to write this review on the 200LX using its built-in Memo Editor program.

The display is a CGA-compatible LCD that measures about 2 by 5 inches. Graphics resolution is 640 by 200 pixels. This small a display could make for very small characters, but the 200LX features three character sizes which compare well with those in today's typical notebook computers. The display is not backlit, so good ambient lighting is required to make it readable.

The 200LX comes in two models: with one or with two megabytes of RAM. The model reviewed here is one megabyte. The system RAM is battery-backed-up static ram. Memory contents are preserved when power is turned off. In fact, when the unit is turned on, the program in use when the power was turned off continues from exactly where it left off. No reboot required.

A serial port is provided on the side of the 200LX, requiring a ten-pin connector and cable to access. It then becomes a PC-compatible serial port operating at all standard baud rates up to 115,000. It can be used to control modems, TNCs, HF rigs, etc.

An industry standard PCMCIA type II interface slot is provided for expanding the unit with more memory, a modem, or other device. Memory cards of 40 or more megabytes may be used to provide additional user program and data storage. Memory plugged into this slot appears as the system's "A" disk drive.

The 200LX operates from just two AA batteries that provide a typical four weeks of use between battery changes. An additional coin cell provides memory backup protection while changing the main batteries. NiCd cells may be used, and the 200LX even includes NiCd charge control circuitry.

Loads of Built-in Software

The HP 200LX includes a number of top-quality programs. All programs use a Windows-like drop-down menu motif that provides easy control and use.

The following are the major programs:

- *Appointment Book:*

Week-at-a-glance, month-at-a-glance, and six-month calendar;
Daily schedule with appointment alarms;
Daily, weekly, monthly, and yearly repeating events and appointments;
To-do list with automatic carry-over of past due items.

- *Pocket Quicken:*

Enter and edit transactions in checking, savings, credit card, and cash accounts;
Review account balances and register;
Reconcile accounts;
Create and print financial reports;
Share data with desktop versions of Quicken.

- *Lotus 123 v.2.4:*

Worksheets up to 256 columns by 8,192 rows;
Graphics;
Database commands;
Macro creation and execution;
@ functions from @ABS to @YEAR.

- *Phone Book:*

Alphabetical list of names and numbers;
Contact information cards;
Search and sort on any field.

- *Memo Editor:*

Text entry and editing including block cut/copy/paste, search and replace, bold, and underline;
ASCII file format for reading and editing;

Outliner with promote and demote features.

- *HP Financial Calculator:*

General and technical math functions;
Time-value-of-money functions;
HP Solve equation-writing capability plus equation plotting;
Currency and unit conversions;
Algebraic or RPN data entry;
Cash flow analysis (IRR, NPV) and statistics functions, both with plotting capability.

- *Database:*

Create and modify database templates;
Add, delete, and edit records;
Search and sort by field or text.

- *World Time and Stopwatch:*

Local and world time for over 450 cities;
World map customer city list;
Timer and stopwatch.

- *Data Communications:*

Transfer messages or files via modem or connection to the serial port;
VT-100, ANSI, and TTY terminal emulation;
Kermit, ASCII text, and X/Y/Z modem file transfer capability;
File capture capability saves data from terminal session.

Photo B. The 200LX can control your HF rig via a DOS-based program available for all of the popular rigs that sport a computer connection.

All programs are included in the on-board three megabytes of ROM. Programs are launched by pressing one or two keys assigned to the program. Just press the Lotus 123 key and there it is. This makes it very simple to jump from program to program . . . you don't even have to end a program before going to another. For example, you can be in the middle of the data communications program and a packet QSO, and you want to use the database program to check your log. Simply press the two-button sequence to launch the database program. When finished, the terminal program continues exactly from where you left off.

Some Ham Uses

The Database program can be used to develop a logbook database quickly to track all your contacts. The database can be searched or sorted by date/time, call, name, state, or country, or any user-defined fields you decide to enter on your logbook. The 200LX can be located in a small spot in your operating position, not dominating the area like a desktop or even a notebook PC would. I have a database that contains frequency, location, description, and channel numbers for all the memory channels in my Yaesu FT-411, PRO-43, PRO-2006, and TS-440 radios . . . a total of 750 memories locations!

The 200LX can control your HF rig via a DOS-based program available for all of the popular rigs that sport a computer connection. Additional rig features, like custom scanning, additional memory channels, and automatic frequency logging are provided. You will appreciate the fact that the 200LX is relatively quiet . . . it generates little RFI.

The 200LX works nicely as a computer connected to a TNC as part of a packet station. The built-in communications program provides good capabilities for this function. For the ultimate shirt-pocket packet, combine a 200LX with your favorite micro-HT and a small TNC (like the cigarette-box-sized PacComm PicoPacket). A complete packet station that fits in three pockets!

The built-in appointment and to-do list manager are useful to track contact schedules, nets, and other activities. The appointment function includes an audible alarm that will sound even if you are in another program. Each appointment may include an audible alarm to alert you to a user-specified number of minutes ahead of time. For example, you can set an appointment to sound and remind you of the swap net. The 200LX will sound the alarm at the appointed day and time whether it is off or on or whatever program it happens to be running at that time.

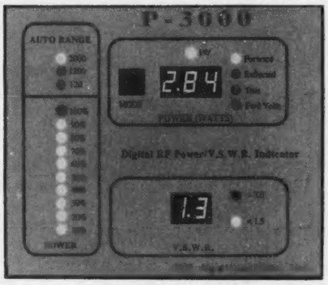
The Worldtime application allows you to easily look up hundreds of cities around the world. Each city contains present local time, latitude, longitude, phone prefix, and location on the world map. An available program converts the map into a dynamic map of the world with the sunrise and sunset areas displayed.

So . . . Is This Thing Worth $500?

You have to answer that for yourself. The HP 200LX is a very well made and useful pocket computer. It's second to none on the market in fulfilling the intended business and personal schedule and activities management roles, and the 200LX offers these features in a size that will appeal to many hams. ■

RF Applications, Inc.

P-3000 Digital RF Power/V.S.W.R. Indicator



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☐ Accurate, peak reading
☐ Bright numeric displays
☐ Autoranging bargraph
☐ Made in the U.S.A.

An *Available* Meter With A High V.S.W.R. Relay

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800.423.7252

73 Review

Number 13 on your Feedback card

by Michael Geier KB1UM

Standard Radio Corporation
P.O. Box 48480
Niles, IL 60714
(312) 763-0081
"WBander" C508A Dual-band HT
Price class: $345.00

Teeny Talkie!

Standard redefines "small."

Do you believe in love at first sight? I do, and I always have. If I ever were in doubt, my first look at the new Standard C508A made me believe again. OK, I admit it, I'm a pushover for tiny electronic gadgets. When Standard released the ultra-small, single-band C108A last year, my interest was definitely piqued. But, when I saw this even smaller, dual-band HT at Dayton, I was absolutely floored, a feat not easily accomplished with this slightly jaded reviewer. This radio isn't just somewhat smaller than other walkies; it's in a whole new size class. I knew I just had to have one right away, and out came the ol' credit card. Although hundreds of the rigs were sold at the hamfest, I was lucky enough to get one of the last ones there.

You Gotta Be Kidding

At about 2-1/4" x 3-1/3" x 1", this incredibly tiny dual-bander looks like a shrunken, well-made mockup of a walkie, right down to its scaled-down rubber duckie. Surely it can't be a real radio! As soon as I handled it, though, I knew it was, indeed, a real HT. The fit and finish are as fine as on any rig made, and the overall feel is solid, despite the total weight of about 5-1/2 ounces, including batteries!

OK, so it's a real rig. But what can it do? How about both 2 meters and 440? How about CTCSS encode *and* decode? How about 60 memories, two call channels, and multiple VFOs? Happy yet? There's lots more, including band and memory scanning, menu operation, and very extended receive capabilities, with an AM detector for the aircraft band!

The Basics

The radio looks like most other HTs, only smaller. It has the usual rubberized PTT and lamp buttons on the left side, along with a "function" button which is used with the other controls to set various parameters. The LCD is decent sized for such a small radio, and shows your operating frequency, memory channel number, offset direction, S-meter, tone status, and other things. It's well laid out and easy to read. The lamp button lights it up well with two green LEDs, which stay on as long as you keep operating the controls and then go out a few seconds later. If you want, you can lock them on.

On top are the antenna connector, mike and earphone jacks, and the dial knob. In keeping with the excellent weatherproofing of the case, there's a rubber cover over the jacks, and it stays attached when you flip it up, so you can't lose it. Also, the rubber from the PTT button extends up to the antenna jack. The antenna jack is not the usual BNC type, though. Instead, it's a screw-on SMA jack of the same kind used on some hand-held cellular phones. It's much smaller than a BNC, and the rubber of the antenna mates directly to the case's rubber, keeping water out much better than could be achieved with a BNC. Don't be disheartened, though, because an SMA-to-BNC adapter can be had at radio dealers for a couple of bucks, allowing you to connect any kind of antenna you want. I got my adapter for $3.00 at one of those "bins and bins of connectors" dealers at Dayton, and several folks mentioned that you can get them at Radio Shack, although I don't know the catalog number.

Below the LCD are five buttons, and there are two more below them, with the speaker and mike at the bottom. On the right side of the radio is a large volume control. Where's the squelch control? There isn't one! The squelch is preset to be fairly sensitive, and it works well, opening on weak signals but staying closed on noise. If, though, you're in a high-noise environment and need a tighter squelch, you can set it from the menu to any one of five higher settings, cued to the S-meter reading. I haven't had to do it, and I don't miss the squelch control, which often gets accidentally misadjusted on my other HT.

The batteries go in the back, under a sliding cover. To prevent the cover's coming off, there's a nifty lock on the bottom of the radio which clicks solidly closed.

Of course, the basic point of this thing is its size. With its approximate dimensions of a pocket pager, you can't help but take the radio with you wherever you go. With this remarkable feat of miniaturization, something had to give, and something did: the transmit output power. The rig puts out 280 mW on both bands. Admittedly, it's not much compared to the 2.5 to 3 watts you get from bigger HTs. Can you really do anything with 280 mW? Surprisingly, you really can! In addition to the obvious hamfest and short-range simplex applications, I was able to work four or five repeaters in Dayton, and several at a friend's house in Indiana, on the way home. And I don't just mean I could key them up; I could really communicate through them, usually with full-quieting signal reports. Not bad for such low power.

The great part about the low-power operation is its easy battery requirement. Although an optional NiCd pack and charger are available, the rig isn't supplied with them, and you don't need them. Probably the best aspect of this rig, aside from its dimensions, is that it operates from two alkaline AA cells. Never again do you have to wonder whether you charged your pack, or worry about buying expensive, new packs every couple of years. Just stick two AAs in and go! If you really want rechargeables, you can use the Ray-O-Vac "Renewal" alkalines. I've had little luck using them in most high-current applications, but they work great in this HT, thanks to its low 280-mA transmit current draw.

What It Does

This little gem does a great deal! Receive frequency coverage is quite wide, from 100–200 MHz, 300–400 MHz, 400–519 MHz and 700 to almost 1,000 MHz (cellular locked out, of course). Transmit is limited to the ham bands, but can be extended for MARS and CAP. In actual use, the radio doesn't quite reach all the frequencies it can display. Although it will let you tune those wide frequency bands, the PLL tends to unlock at the extreme edges of the bands, which is not at all unreasonable, given how huge the frequency spans are. As with many HTs, the display blinks when the PLL is out of range. The published specs are from 100–180, 340–400, and 400–480 (they don't mention the 800-MHz coverage), and my radio stays in lock within those segments and then some. Actually, I wish it wouldn't tune to the unlocked frequencies, because that slows band scanning way down as the rig enters into unreachable territory and halts as it tries to lock up. Oh well, I guess that's what the programmable scan limits are for.

The HT offers a VFO for each frequency span (4 total) and two "call" memories, one each for 2 meters and 440, along with 60 memories, each of which can be tuned like a VFO. The usual internal lithium battery backs them up. Unlike most dual-banders, this one lets you freely mix frequency bands from memory to memory. So, you're not limited to dividing the memories into, say, 30 per band. That's great if you live where most of the nearby machines are on one band. It's also great for scanning, because you can scan frequencies from different bands in any order you like. The scan options are extensive, by the way. In addition to the usual band and memory scans, this radio lets you scan by blocks of 10 memories, by marked memories, or by programmed frequency limits. Amazingly, it lets you enter 10 sets of limits. That way, you can scan the public service bands when you feel like it, and then scan the ham bands later on without having to re-enter anything. It's pretty nice.

As I mentioned, CTCSS encode and decode are included. The usual 39 tones are supported, and the radio will scan through them for you, looking for a tone being transmitted by a repeater. As with most rigs, you can set up to transmit tone, or both transmit and receive with it. There's also a 1,750-Hz tone burst function, in case you go to Europe and want to key up. (Don't forget to get that reciprocal license first!)

Each memory can hold separate transmit and receive frequencies, and they can even be on different bands! Yup, you can work crossband with this thing. It doesn't appear to do full duplex, but I've never found a use for that anyway. In addition to the separate frequencies, you can also set different offsets into each memory, making the programming of odd-split repeaters easy.

Selectable automatic power-off and battery saver times can be set from the menu. Also, a handy programmable key feature lets you put one of the SET mode functions into an easily accessible keypress so you don't have to scroll through the menus to get at it.

What It Doesn't Do

While offering most of the modern amenities, this HT is a little different in some ways. The radio comes with the antenna, a belt clip, a hand strap, and the manual. That's it. Naturally, there's no wall charger, because there's no NiCd pack. At first, I was puzzled by the inclusion of the belt clip. After all, who would possibly want to put such a tiny radio on a belt? After trying to carry the rig in my shirt pocket, though, I realized the wisdom of adding the belt clip. This thing is so small and light that it will easily go flying out of your pocket if you bend over. I attached the clip and solved the problem.

Some features offered on many HTs are not present. The biggest omission is DTMF capability. I don't miss the DTMF paging stuff, since nobody uses it anyway. But, there's no way to send DTMF tones, so you can't use the radio for autopatching. I thought about that before buying the rig, but then I asked myself when I last actually used a patch, and I couldn't even remember. Although autopatch can be handy, I think it is used mostly by new hams until the thrill wears off. I suppose you could play the tones from a pocket dialer into the mike, but I haven't tried it.

There's no provision for direct DC input. No, you can't plug in car power and get five watts out of this thing! The rig is made to operate on no more than 3.5 volts, and higher voltages will damage it. With the transmitter's low current drain, it really is silly to try to operate on anything other than batteries. Also, there's no "low power" setting. With a maximum 280-mW output, who needs it?

Many dual-banders can listen to two frequencies at once. Not this one. According to the block diagram (the unit comes with no schematic), both the VHF and UHF receiver sections share the same IF and detector circuits, being separate only in the front ends through the first mixers. Oh well, who really needs dual reception anyway? I've used it now and then, but can certainly live without it. Unfortunately, there's also no priority watch, and that's a shame, because it would have helped make up for the lack of dual reception. It's strictly a software function, and could have been included at no extra cost.

There's no low-battery indication of any kind on the display. I've yet to actually run a set of batteries all the way down (!), so I don't know what happens when you do. Also, there's no automatic repeater offset, and stepping through the menus to select the offset direction is a pain. I set up my programmable key for this function, making it easy as pie.

On the Air

Using the radio is much easier than I expected it to be. The menu operation is fairly straightforward, and I was able to figure out how to put a few repeaters and their offsets and CTCSS tones into memory without even looking at the book. I'm an old hand, though; less experienced users will probably have to read the manual.

The receiver is quite good. Although the sensitivity spec is not quite as hot as on my bigger HT, I can't really tell much difference on weak signals, as long as I use the big HT's antenna on both radios. With the included mini-antenna, though, sensitivity in the VHF public service band drops off quite a bit, although it's almost as good as the bigger one in the ham bands. For its size, the diminutive duckie is darned decent. Adjacent-channel receiver selectivity is about average; I've seen 'em tighter and I've seen 'em looser. The literature claims exceptional intermod rejection, but I have no way to test that, as I live in the country, far from interference sources. As far as birdies are concerned, I haven't found any, although I admit I haven't scanned every frequency on this very wide-band thing. The scan speed is pretty fast, but the memory scan is a bit slower. Still, it's on a par with most HTs.

The transmit audio is among the best I've ever heard. I got several unsolicited comments on how great the HT sounded. Receive audio is another story. The rig only puts out 100 mW at 10% distortion, and it really shows, especially with the necessarily small speaker. At anything more than very moderate volume levels, the sound clips and distorts quite a bit. Wisely, though, the designers let you turn it up anyway. Even with all the clipping, it's quite intelligible, if not pleasant, and the extra volume really helps outside. In the car, you'll have to hold it up to your ear or use a speaker-mike.

What I Liked

This tiny HT does just about everything people actually use, and then some. It's small, it's cute, and it's fun. It's well made, it performs very nicely, and it runs on two AA cells. The wide receiver coverage is great.

What I Didn't Like

The LCD window is convex and high; it's gonna get scratched if you're not careful. Also, its shape makes it act like a lens, causing overhead room lighting to glare from it, obscuring the display. Although the display can be viewed at any angle in ambient light, you have to look at it from above when you use the backlight or it washes out.

As I mentioned, you can't send DTMF. Some keypadless rigs let you do it by programming the numbers into memory first; that would have been nice. I guess there just wasn't room for the DTMF chip.

Although the menu operation is not hard to remember, a wallet-sized cheat sheet would still be handy. But, it would have to be better prepared than the manual, which is written in "Jenglish" and contains phrases such as "at initial state, this function is set My key" and "the Frequency Lock is stored after done the All reset or VFO reset." The Big Three appear to have learned to use native English speakers to edit their manuals, and I hope Standard catches on soon. I also hope they start including a full schematic. We're hams, not just consumers, and we want to know what's inside.

Conclusion

This tiny radio continues Standard's long tradition of making tiny electronics. Back in the '60s, they made the Micronic Ruby series of ultra-small AM pocket radios (if anybody has one he or she will part with, please contact me; I've been looking for one since I was a kid!), and now they're doing the same thing with HTs.

I love this thing! In fact, I'm so fond of it that it makes my girlfriend jealous. With its low output power and lack of DTMF, it is clearly not intended to be your primary rig. But, if you can live with those limitations, you will have a ball with this radio, assuming you like your toys tiny, as I do. It's especially nice for hamfests and travel; you won't leave it home. The C508A is an awesome feat of engineering, and, being the least expensive dual-bander around, it's a bargain, too.

A Simple Precision Voltage Standard

A tool for the serious builder's workbench

by Marion D. Kitchens K4GOK

Standards are an important part of any serious electronic builder's workbench, necessary for checking and verifying purchased equipment, and absolutely critical for setting up and calibrating a builder's new creations. A known, precision voltage reference is perhaps one of the most important standards needed, since checking and calibrating the output of test equipment depends on known, accurate references. Almost everyone has a digital multimeter capable of at least three-place decimal readings, and some with four-place readings. But how do you know if those readings are accurate? Many make the mistake of believing that just because an instrument reads all those digits they are accurate to that degree. Accurately known voltage sources are important in setting up digital-to-analog, and analog-to-digital converters. Digital ammeters can be calibrated or checked with easy-to-find surplus precision resistors (to at least the 1% accuracy level), if you have a known voltage reference like the one described here. The stability of voltage sources in your operating equipment can be measured by comparison to a stable, known reference. The precision voltage reference described here is designed to assist the serious builder in resolving the above problems with an easy-to-build and -use voltage standard. A PCB layout is provided, including a built-in 110 VAC power supply for those builders who desire to make their own. FAR Circuits offers boards to make building easy (see Parts List). All parts are available from sources such as Radio Shack, except for the AD586 chip, which is available from Newark Electronics and Allied Electronics.

Precision
Voltage
Reference
OFF
P
R
5.00
K4GOK

Photo A. The completed unit.

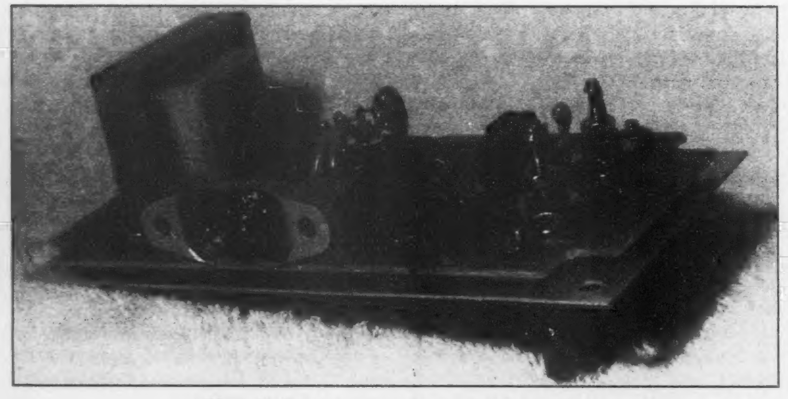


Photo B. Components and connector mounting.

There are no tricky adjustments or fussy components. The circuit is a hassle-free voltage standard. All components are mounted directly on the PCB, making for a integral unit that is easy to assemble and mount in an enclosure. This reference standard provides a basic precision of two parts out of 5,000, or about 0.04%.

The Circuit

The circuit is based on the Analog Devices AD586 integrated circuit. Except for a power source, this IC has everything needed built directly into the chip, with laser-trimmed resistors "fine-tuning" the output to 5.000 ± 0.002 volts. Internal temperature-compensating resistors are also laser-trimmed at manufacture to maintain the precision output over a range of 0 to 70° C (M grade device), well within any normal use a builder might encounter. If you have access to a higher precision voltage source, there are provisions for further fine adjustment of the output voltage—if you need more precision! The project described here can be operated from 110 VAC or from a simple 10- to 25-volt source, such as an auto battery under the operating table, or for portable operating from two 9-volt transistor batteries in series. Current drain from the battery is about 15 mA, with most of that for the LED "on" indicator, thus offering long portable use on the 9-volt batteries. Functionally, the project consists of a power supply and the AD586 chip. This is a very simple circuit with excellent performance. Figure 1 shows the complete schematic of this precision voltage standard.

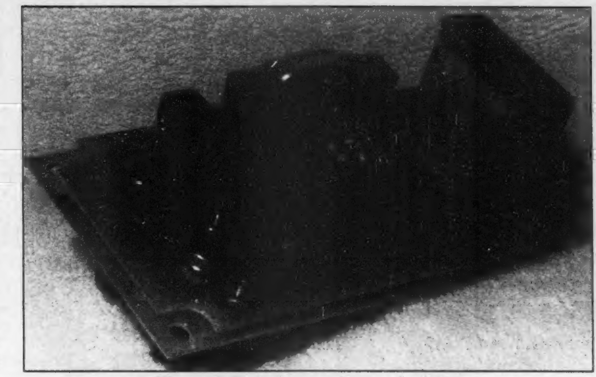


Photo C. Switch mounting and wiring.

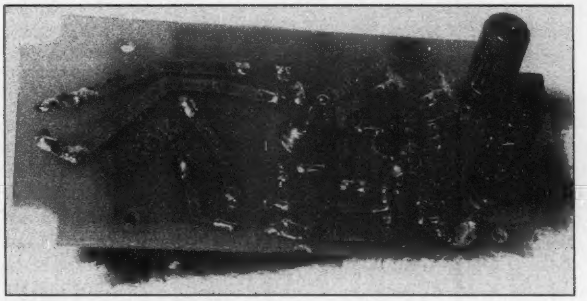


Photo D. Switch, LED, and binding posts on foil side of board.

Construction

Construction of this simple project is very straightforward when using the PCB, shown in Figure 2. The PCB layout is shown from the foil side. Don't forget to reverse it if using the Tech 200 or similar technique. The circuit is simple enough that perf board and point-to-point wiring is a practical alternative to the PCB construction. Placement of the components is shown in Figure 3. The photos show the PCB construction, and the mounting of the board inside the enclosure. A Radio Shack enclosure (#270-233) will house the completed board. Note that the on-off switch and the output posts are mounted from the foil side of the PCB and connections are made via short pieces of solid wire. The LED is also mounted from the foil side of the board. The entire assembly is then mounted to the cover of the enclosure. The 110-VAC input and the external power connectors are mounted directly to the PCB, using Superglue and support blocks as shown. The photos show how the parts are mounted on the PCB to make a small, self-contained unit. There are no adjustments necessary to this precision voltage source—this has all been done for you by the manufacturer. This is a "plug in the parts and use" type of project. However, for those who desire the utmost in precision and have access to a more precise voltage reference, it is possible to make small adjustments to the output voltage. A 10k trimpot can be connected between the output and ground, with the wiper of the pot connected to pin 5 of the IC.

According to the Analog Devices data sheet, this will allow adjustments of about 300 millivolts in the output. No provisions are incorporated on the PCB for this trimming, but there is ample space for the addition. Of course, if you are attempting to achieve a more precise 5-volt output than the basic chip provides, then you must have access to a known voltage source of the desired precision. I don't have access to the standards at the National Institute of Standards and Technology, so I settled for the 2-millivolt precision of the basic chip as built by Analog Devices.

> ***"The circuit is simple enough that perf board and point-to-point wiring is a practical alternative to the PCB construction."***

Check-Out

Check-out of this project is quite easy. As always, check for any wiring errors, solder bridges, and the like. Make sure the rectifier is oriented properly; some rectifier units are not well-marked. With the chip out of its socket, apply 110 VAC and turn on the switch. The LED should light immediately. Next check that there is about 25 VDC at pin 2 of the IC socket. If the LED does not light or the voltage is wrong, find the problem and fix it before proceeding. Next turn off the power and wait for the LED to go out completely. Remove the power cord from the AC outlet. You want no voltage on the IC socket when you plug in the AD586 chip. Make sure the 30-µF and 1-µF caps are discharged. Install the AD586 chip, making sure it is oriented properly. Connect your voltmeter to the 5.000 VDC output connectors. Reconnect the AC line cord and turn on the switch.

The LED should light and the voltmeter should read 5.000 volts immediately. Check for proper battery operation by removing the AC line cord and connecting a 10- to 25-volt sup-

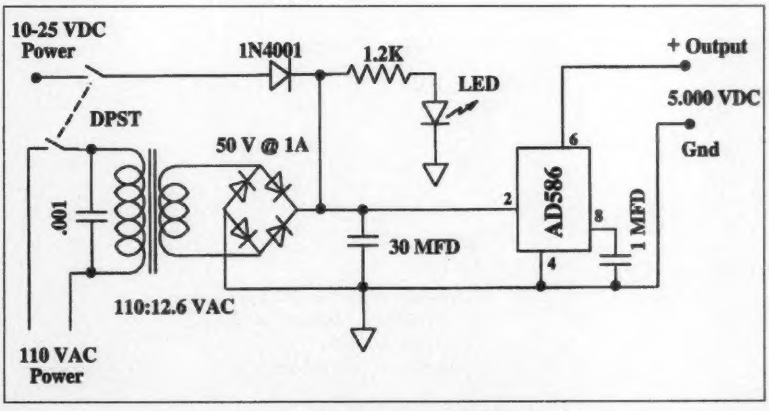


Figure 1. Schematic for the precision 5.000-volt reference.

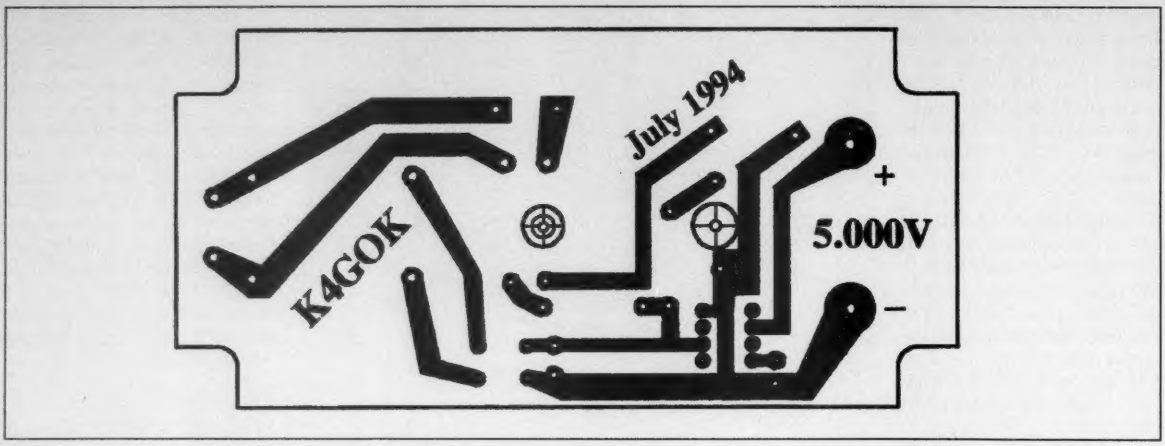

K4GOK
July 1994
+
5.000V
−

Figure 2. PCB foil pattern—view from copper foil side.

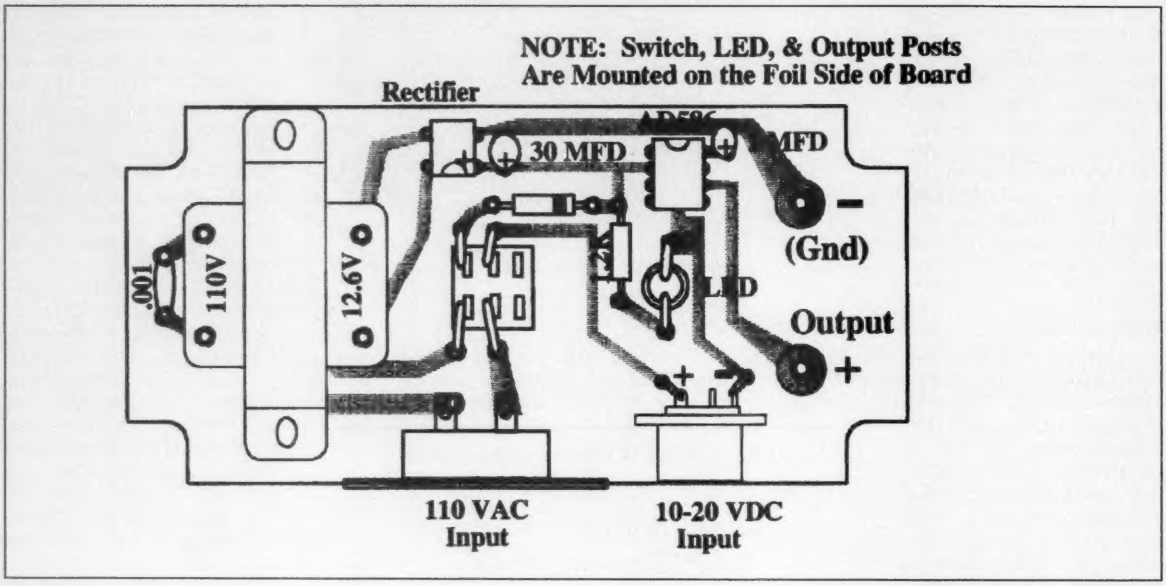

NOTE: Switch, LED, & Output Posts Are Mounted on the Foil Side of Board
Rectifier
AD586
30 MFD
MFD
.001
110V
12.6V
LED
−
(Gnd)
Output
+
+
−
110 VAC Input
10-20 VDC Input

Figure 3. Parts placement—view from component side.

Parts List

Resistor	1.2k @ 1/4 W
Capacitors	30 µF @ 30 V 1 µF @ 30 V 0.001 µF @ 1 kV
Diode	1N4001
Rectifier	1A @ 200 V
LED	
Binding posts	
Toggle switch	
Transformer	12.6 V @ 300 mA
DC power connector	
110 VAC power connector	
Container	
AD586 chip	Newark Electronics or Allied Electronics
PCB	FAR Circuits, 18N640 Field Court, Dundee, IL 60118 ($6.75 + $1.50 S&H per order.)

ply to the external DC power jack. Turn on the switch. The LED should light and the output should be 5.000 volts as above. If the LED doesn't light, check for proper polarity from the external supply. Note that the battery and the internal AC power supply are diode isolated, and therefore can be left connected without any interactions between the supplies.

Performance Tests

Warm-up tests from a cold start showed no measurable charges in the output voltage over a 10-minute period. The warm-up voltage was stable within the ± 0.0005 limits of the test equipment. The output voltage was checked after a series of other tests, and remained unchanged. Output stability was also measured over the range of 100 to 130 VAC line voltage. There was no measurable voltage change over this range. DC supply variations did produce measurable changes, as shown in the graph of Figure 4. Note that the unit requires at least 10 VDC for a proper output voltage. Supply voltages below 10 VDC produce a sharp drop in the output voltage. Also note that the output remains very stable up to the maximum supply voltage at which it was tested, 25 VDC. The maximum change in output voltage was 0.001 over the supply range of 10 to 25 volts. Note the high stability of the output voltage during all of these tests. Figure 5 shows the results of comparing three different DMMs. The test setup shown at the top of the figure illustrates the technique used to get increased digital resolution on the DMMs. Note that this test only compares one DMM with another, and does not indicate which is more accurate in absolute terms. The sidebar describes techniques for improving the resolution, but not the accuracy, of DMM measurements as used in these performance tests.

Conclusion

The AD586 chip makes an easy-to-build, high-precision voltage reference. The unit described in this article can be used on the workbench or in the field. Those needing a voltage reference for aligning or calibrating new test equipment or verifying purchased equipment will find this unit a good investment of time and effort. When you need a voltage reference, there is no substitute for a good, known-precision unit.

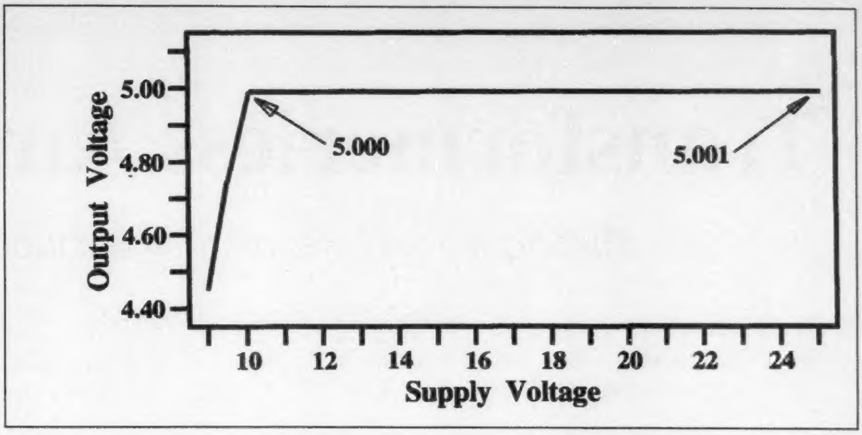
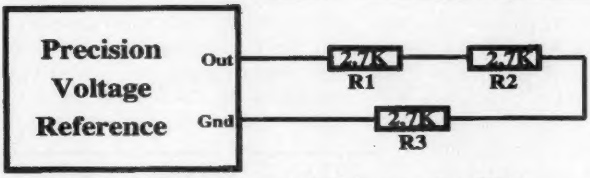


Figure 4. Output voltage vs. supply voltage.



Measure Voltage Across Each Resistor And Sum

	ALFA 2360	Beckman 300	RS 22-188
V_{R1}	1.649	1.649	1.638
V_{R2}	1.679	1.678	1.667
V_{R3}	1.677	1.677	1.665
Sum	5.005	5.004	4.970

Figure 5. Comparing digital voltmeters.

Going Beyond the Last Digit

It is possible to obtain readings with greater resolution than that of the last digit of your DMM. The technique depends upon the idea that the DMM is similar to a digital counter and as such has an input gate counting a series of input pulses. Both the input gate and the series of input pulses are repetitive, but not necessarily synchronized. That means a particular pulse near the end of the input gate will sometimes make it into the count and sometimes will not. Careful logic and reasoning about the events will show that if the last input pulse makes it into the count half of the time, the true measurement will be halfway between the lowest and the highest digit shown in the last place of the count. Thus, if a measurement reads, for example, 2.548 half of the time and reads 2.549 for another half, the true measurement is halfway between those two values, or 2.5485. This is equivalent to taking a time average of the readings. Likewise, if the reading is 2.548 about a quarter of the time and 2.549 the remaining three-quarters of the time, the true value is close to 2.5487 or 2.5488. If the DMM were connected to your computer so that all the values over a minute could be averaged, you could determine a value that was at least one greater order of magnitude in resolution. In other words, you could easily measure one digit beyond the resolution of your DMM. This is theory, of course, and other factors also affect the limits of resolution.

As a practical measure, you can use a timer and simply measure the cumulative time the last digit is a particular value over a period of time. The percent time is then an indicator of the next digit beyond that on the display. For example, if your measurement is 2.548 for 48 seconds out of one minute and the other reading is 2.549 for 12 seconds, then the value beyond the last digit should be 12/60 = 0.2. The true value then would be 2.4582.

Note that this does not improve the accuracy of your meter. It simply lets you make measurements with greater resolution. This can be important when two voltages have to be exactly the same value, or in measuring the difference between two voltages. A better DMM would be the preferred method, of course, but this technique will provide improved resolution when no other means are available.

Transformerless Amplifier

Putting an old twist on new technology.

by Robert W. Vreeland W6YBT

Recently I became the proud owner of an MFJ-9020. It puts out 3 watts when powered by an Edlie TD626 12-volt regulated supply (Edlie Electronics, 2700 Hempstead Turnpike, Levittown, NY 11756-1443). My thoughts then turned to increasing the output. Having previously experimented with high voltage MOSFETs, I decided to build an amplifier using a pair of 600-volt Supertex VN0660N5s (SuperTex Inc., 1225 Bordeau Drive, Sunnyvale CA 94088-3607).[1,2] The result was a 20-watt amplifier that weighs just two pounds, including the power supply. It puts out a clean signal without objectionable clicks or hum. The power supply is transformerless, and puts out 140 volts DC at 350 mA.

Transformerless operation was popular in the days of AC/DC vacuum tube receivers. These radios invariably came in carefully insulated plastic cases. After all, there was no transformer to isolate the operator from the 120-volt line. Our amplifier is housed in a 4" x 6" plastic card file box. The panel and the chassis were cut from a 0.10"-thick sheet of Bakelite. All controls are plastic. Even the tuning capacitor has an insulated shaft coupling. The RF input and output connectors are isolated from the high voltage circuits by Teflon-insulated RF transformers and by careful parts layout. Even so, the RF connectors should be grounded via the third wire in the power cord. A screw connector is provided for this purpose. Obviously, an AC-hot antenna is something that must be avoided at all costs. The amplifier was designed so that all adjustments (including setting the bias) could be made without removing the unit from its case. If out-of-case testing must be done, an isolation transformer (Triad N-54M or Stancor G15-150) must be inserted between the power source and the amplifier. This is definitely a project for the experienced builder who likes to do his own parts layout.

> ***"This is definitely a project for the experienced builder who likes to do his own parts layout."***

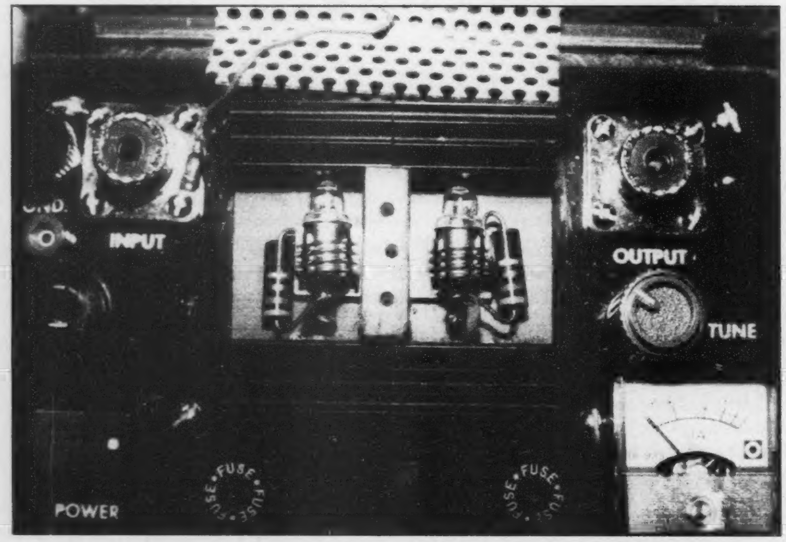


Photo A. Lamps mounted in fuse clips are used for balancing the MOSFETs. Note the neon bulb RF indicator and the overcurrent LED at the right of the RF output connector. The RF connectors and the perforated aluminum heat-sink cover are grounded for safety.

The MOSFETs

An SCR crowbar protects the MOSFETs against a bad antenna mismatch. Operating with no antenna at all simply blows the 1/2-amp fuse (F2).

The method of balancing the push-pull MOSFETs is unusual. The manufacturer specifies that the gate voltage needed to turn them on may be anywhere between 2 and 4 volts. This is typical for high voltage MOSFETs, regardless of who makes them. Consequently, a separate bias trimpot is needed for each transistor. A positive bias is required. The trimpots are accessible through small holes in the panel. A matched pair of #222 flashlight bulbs is used to indicate whether the transistors are balanced. Each lamp is shunted by a 6.8-ohm 1-watt resistor (R14 and R15) and inserted into the source lead of the MOSFET. The lamps are mounted in fuse clips under a grounded cover on the top side of the panel. The trimpots are adjusted for equal lamp color at 20 watts output. They control the amplifier output, in addition to balancing the circuit.

We used our Weller model 8100 soldering gun and Variac to select a matched

HF for only $549

HOW IT ALL STARTED

We wanted to offer the most affordable HF rig in the industry and still provide real performance for even the most experienced ham. In recent years, many hams requested a "back to basics" transceiver that was simple to use. We reviewed all the latest design techniques, selected the best concepts from the 20 rigs we designed over these 25 years and asked 500 hams across the country for their ideas.

WE CALL IT THE SCOUT

Every feature can be mastered in minutes. No modern rig is as easy to use. It only takes a second to change bands. Plug-in modules are available for 160-10 meters including WARC. Single conversion and crystal mixing are the foundation of this 90 dB dynamic range receiver. That's the strong signal performance of rigs costing 3 times as much! It's sensitive and receive audio is sparkling clean with less than 2% distortion. The ideal selectivity for every band condition is at the touch of a knob. This patented "Jones" filter provides variable I-F bandwidth from 500 Hz to 2.5 KHz.

HERE'S HOW IT'S USED

MOBILE

Hams complain about today's cars having precious little space for gear. The SCOUT is the smallest HF rig in the industry (excluding QRP) measuring only 2.5" x 7.25" x 9.75" and runs directly off the 12 VDC car battery. If the SCOUT won't fit your car, nothing will. The optional noise blanker reduces ignition noise from both your car and the one that just drove by.

PORTABLE

Business travelers and vacationing hams typically set up a briefcase or small travel bag to include the 5 lb SCOUT, wire or whip antenna and lightweight power supply like our Model 938 switcher (its only 3 lbs!). It is surprising how many hikers and cyclists take along their SCOUT using some clever battery arrangement.

14.
7. 238.0
SCOUT 555
40 METER
20 METER
AUDIO

NEW HAMS

The SCOUT is the most economical way to get started in ham radio. Consider the choice a new ham must make just to test his interest in HF: (1) Spend nearly $1000 or more on a new rig, (2) buy a used radio and take a chance on its condition, or (3) invest in a SCOUT at $549 with a one year factory warranty and our legendary TEN-TEC support.

OLD TIMERS

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$29* Each additional band module

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297	Noise Blanker	$19.50
937	11 Amp Power Supply	$79.00
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700C	Hand Mike	$39.95
607	Weighed Key Paddle	$39.00
291	Antenna Tuner	$89.00

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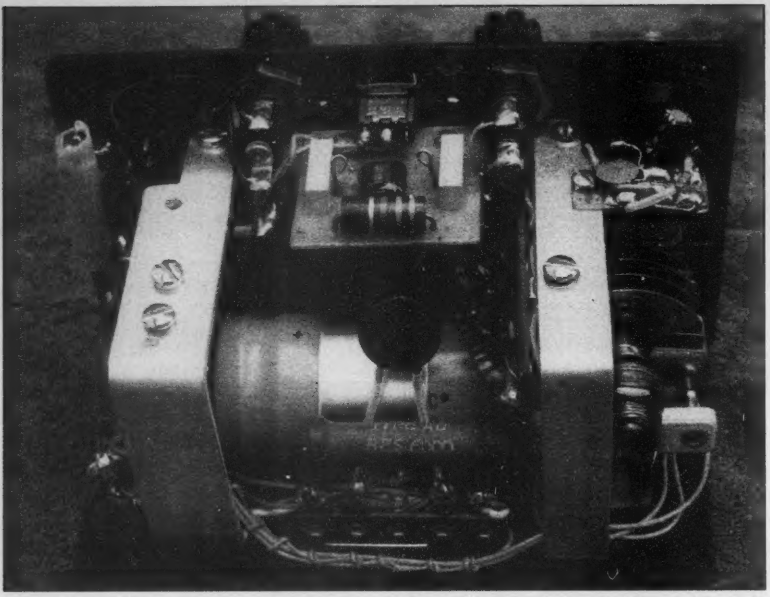

Photo B. The bias supply and trimpots are on the board between the fuse holders. At the right above the tuning capacitor is a little board for the output meter components. The RF output filter is mounted on the right-hand aluminum bracket.

pair of lamps. The 8100 uses two lamps connected in series. The lamps stay in the amplifier circuit at all times. At 20 watts output the filaments are tiny orange dots. Be sure to start with the trimpots set at zero bias. A switch decreases the drive to the amplifier to permit antenna tuning. Alternatively, the MFJ-9020 can be used barefoot for this purpose.

Power Supply

The power supply is a conventional bridge rectifier with a few unconventional changes. Good filtering is provided by a 1,200 µF, 200-volt electrolytic (C5). Without inrush limiting, this capacitor would probably burn out the power switch. We therefore added a Keystone CL-60 inrush limiter (R1) obtained from Hosfelt (Hosfelt Electronics Inc., 2700 Sunset Blvd., Steubenville, OH 43952-1158).

A pair of Radio Shack 273-102A chokes (RFC1 and RFC2) and 0.005 µF capacitors on all legs of the bridge complete the line filter. Without line filtering, the RF radiated by the power line had bad 120-Hz modulation introduced by the bridge rectifier. Be sure to get 273-102A chokes if you can. The newer 273-102B units have a two-layer winding and far too much shunt capacitance for use on 20 meters. If you must use them you will have to completely rewind them with a single layer of wire. Since a fully charged filter capacitor presents a formidable health hazard, a 6k-ohm 10-watt bleeder (R3) was added to discharge it when the power is off. We chose a 6-amp bridge rectifier because of the high inrush requirement. A second CL-60 was added to limit the load fuse-blowing current.

Amplifier

The amplifier is a tuned push-pull circuit. This reduces harmonic output, es-

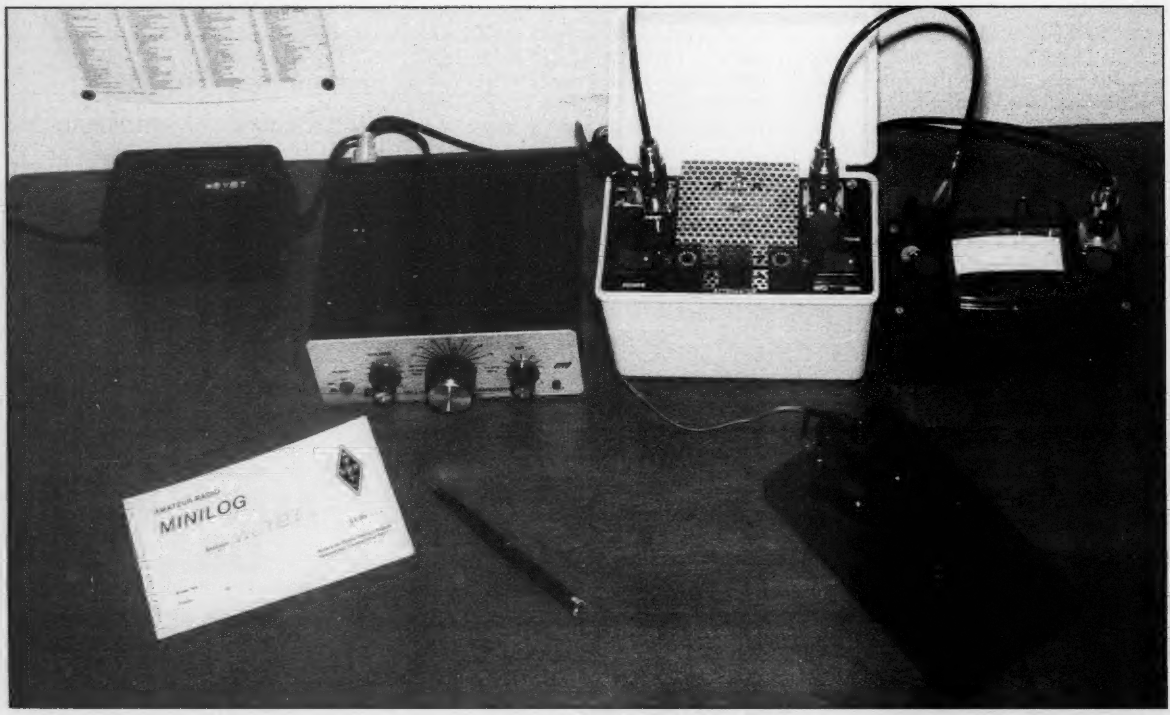

Photo C. The complete station.

pecially the second harmonic. To be on the safe side, we added a low-pass filter taken from page 198 of the 1975 *ARRL Handbook*. Approximate neutralization is provided by a pair of 10-pF 1-kV ceramic disc capacitors (C18 and C19).

We initially had a problem with VHF parasitics. This was solved by inserting two Amidon ferrite beads in each transistor gate lead (Amidon Associates, 12033 Otsego St., North Hollywood, CA 91607), and by installing RFC4. Approximate tuning is provided by a matched pair of 270-pF 500-volt silver mica capacitors (C15 and C16). If possible, use the larger, older type. High voltage polystyrene capacitors would be even better if available. After all, silver mica is not as low-loss as one would hope.

A Hammarlund MC-20-SX 20-pF variable (C17) is used for tuning. These capacitors are still available from Cardwell (Cardwell Condenser Corp., 80 East Montauk Highway, Lindenhurst, NY 11757). The 50-pF MC-50-5 would be a better choice, if available.

Output/Input

The output tuning peak is broad but definite. A sharp peak would indicate undesirable regeneration.

The output transformer (T1) was made by close-winding 10 turns of #20 enameled wire on an Amidon T68-6 core. Number 22 Teflon-insulated hookup wire was used for the two-turn output link. The extra wire was twisted to form a twisted pair transmission line to the low-pass filter. Careful insulation of the output transformer is mandatory. The input transformer (T2) has a 14-turn #24 enameled center-tapped winding. It is close-wound on an Amidon T37-6 core. The primary is eight turns of #24 enameled wire. This wire is threaded through a length of

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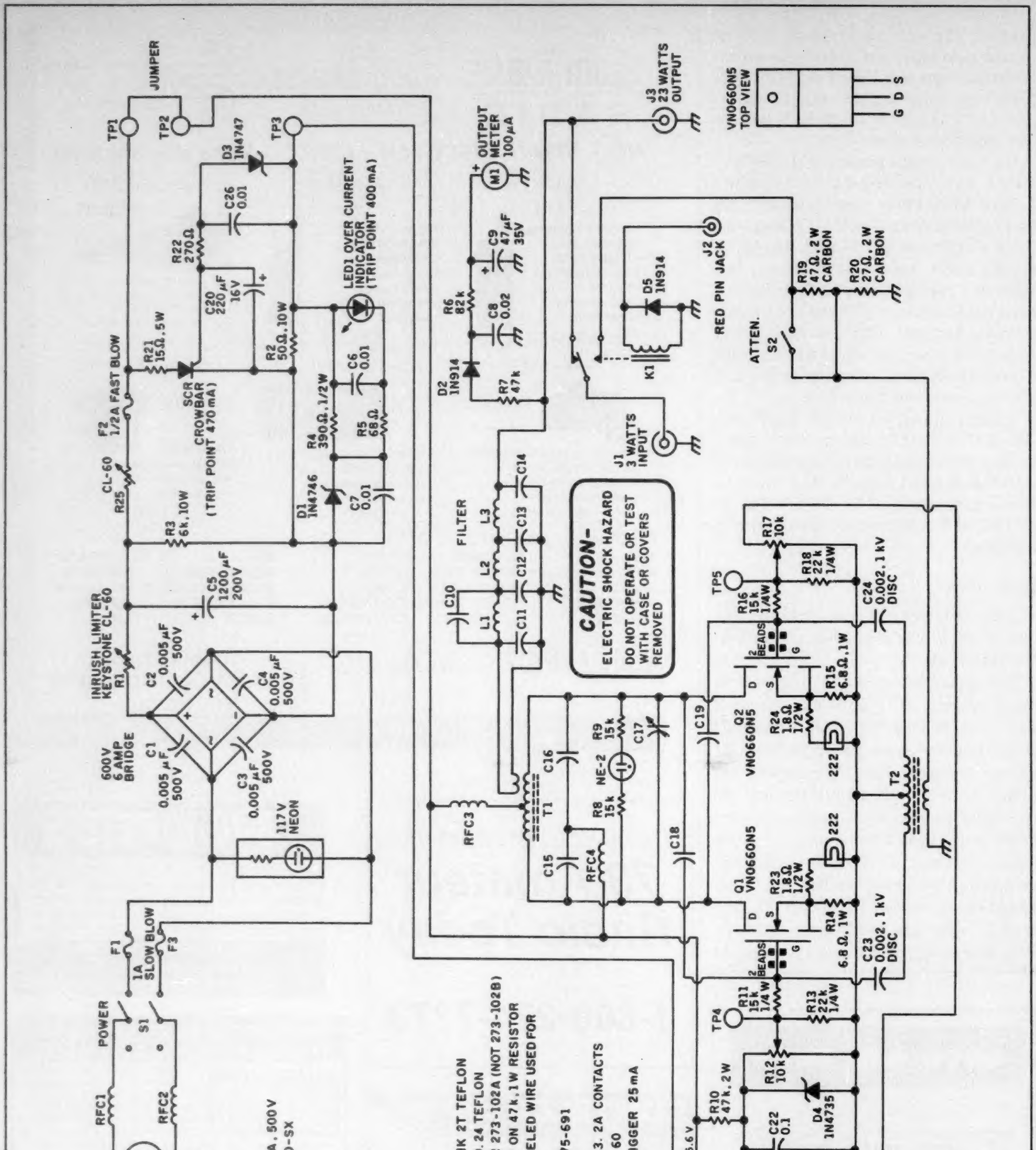
117V, 60 Hz
HOT
NEUT.
GROUND
RFC1
RFC2
POWER
S1
F1
1A
SLOW BLOW
F3
117V
NEON
600V
6 AMP
BRIDGE
C1
0.005 µF
500 V
C2
0.005 µF
500V
C3
0.005 µF
500V
C4
0.005 µF
500V
INRUSH LIMITER
KEYSTONE CL-60
R1
C5
1200 µF
200V
R3
6k,10W
R25
CL-60
F2
1/2A FAST BLOW
R21
15Ω,.5W
SCR
CROWBAR
(TRIP POINT 470 mA)
R22
270Ω
C20
220 µF
16V
C26
0.01
D3
1N4747
R2
50Ω,10W
LED1 OVER CURRENT
INDICATOR
(TRIP POINT 400 mA)
D1
1N4746
R4
390Ω,1/2W
R5
68Ω
C6
0.01
C7
0.01
TP1
TP2
TP3
JUMPER
FILTER
L1
L2
L3
C10
C11
C12
C13
C14
D2
1N914
R7
47k
R6
82k
C8
0.02
C9
47 µF
35V
M1
OUTPUT
METER
100 µA
J3
23 WATTS
OUTPUT
J1
3 WATTS
INPUT
K1
D5
1N914
J2
RED PIN JACK
ATTEN.
S2
R19
47Ω,2W
CARBON
R20
27Ω,2W
CARBON
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T1
C15
C16
RFC4
R8
15k
NE-2
R9
15k
C17
C18
C19
Q1
VN0660N5
Q2
VN0660N5
D
S
G
2
BEADS
R23
1.8Ω
1/2W
R24
1.8Ω
1/2W
222
R14
6.8Ω,1W
R15
6.8Ω,1W
T2
C23
0.002,1 kV
DISC
C24
0.002,1 kV
DISC
TP4
TP5
R11
15k
1/4W
R13
22k
1/4W
R16
15k
1/4W
R18
22k
1/4W
R12
10k
R17
10k
R10
47k,2W
5.6 V
C22
0.1
D4
1N4735
C21
0.05 µF
500V
CERAMIC
DISC
C5-1200µF, 200V ELECTROLYTIC
C15,C16-LARGE 270pF SILVERED MICA, 500V
C17-HAMMARLUND MC-50-S OR MC-20-SX
NE-2-TUNING INDICATOR
C18, C19-10pF,1kV CERAMIC DISC
C10,C11-200pF SILVERED MICA
C12-590pF SILVERED MICA
C13-750pF SILVERED MICA
C14-300pF SILVERED MICA
L1-8T NO.22 ON AMIDON T37-6
L2-10T NO.22 ON AMIDON T37-6
L3-11T NO.22 ON AMIDON T37-6
T1-10T NO.20CT ON AMIDON T68-6, LINK 2T TEFLON
T2-14T NO.24CT ON T37-6, LINK 8T NO.24 TEFLON
RFC1, RFC2, RFC3-100µH, 2A, ARCHER 273-102A (NOT 273-102B)
RFC4-9T NO.22 SPACED FULL LENGTH ON 47k, 1W RESISTOR
R12, R17-10k TRIMPOTS. NOTE: ENAMELED WIRE USED FOR WINDINGS
S1-DPDT ROCKER SWITCH, ARCHER 275-691
S2-SMALL SPDT ROCKER SWITCH
K1-5V SPDT RELAY, ARCHER 275-243, 2A CONTACTS
R1-10Ω THERMISTOR-KEYSTONE CL-60
SCR-6A, 400V ARCHER 276-1020 TRIGGER 25mA

Figure 1. The amplifier uses a tuned push-pull circuit with crowbar mismatch protection. RF transformers isolate the input and output from the high-voltage circuits.

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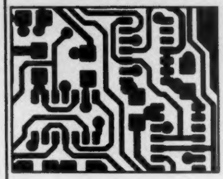

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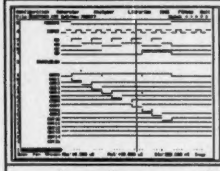

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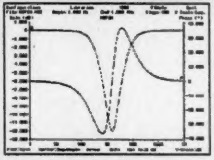

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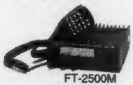

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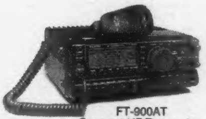

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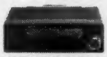

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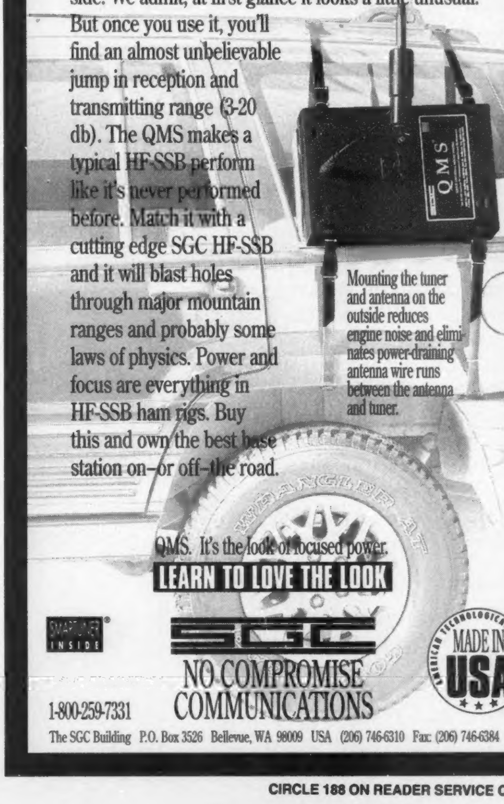

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Teflon "spaghetti" before winding. Again, careful insulation is a must.

The input is via RG-178B/U Teflon-insulated miniature coax. A divider consisting of a couple of 2-watt carbon resistors (R19 and R26) reduces the drive to permit tuning. A rocker switch (S2) jumpers R19 for full power output with 3 watts of drive. If the amplifier is to be driven by a 5-watt signal, a 27-ohm 2-watt resistor should be inserted in series with S2.

A terminal block (TP1, TP2 and TP3) was included to permit metering when an isolation transformer is used. The milliameter terminals (TP1 and TP2) are normally jumpered.

A 50-ohm, 10-watt current sampling resistor (R2) provides the control voltages for the 400-mA over-current LED, and for the SCR crowbar. At 470 mA the SCR connects a 15-ohm, 5-watt resistor (R21) across the DC supply. This blows the 1/2-amp fuse (F2) and saves the MOSFETs.

The Completed Unit

Photo A was taken with the cover removed from the heat sinks. They are bonded together but not grounded. The photo does not show the 1.8-ohm peak current limiters (R23 and R24) which were added later. Bias adjustment is done through the small holes adjacent to the RF attenuator switch, using an insulated alignment tool.

Photo B shows the 1,200-µF filter capacitor, its bleeder and the inrush limiter. The bridge rectifier and the terminal block are hidden behind the left-hand aluminum bracket. The bracket supports the crowbar components. Note the Fiberglas-insulated AC line filter choke in the upper left. The major RF components are on a hidden Fiberglas board. The RF input divider (R19 and R20) is at the left-hand end. Next is an unused section for high-voltage insulation. Then come the input transformer (T2) and the parasitic choke (RFC4). The output transformer (T1) and the tank circuit capacitors are at the right-hand end. The MOSFETs are mounted on the underside of the heat sinks, using mica insulators. A Lucite block supports the tank tuning capacitor. Other blocks hold the panel and the circuit boards.

References:

1. Vreeland, Robert W., W6YBT, "Notes on a Lightweight Portable CW Transmitter With a Transformerless Power Supply," *QEX*, June 1988, pp. 11-13.

2. Vreeland, R.W., "More Gadgets for Your MFJ-9020," *73 Amateur Radio Today*, October 1993, pp. 10-12.

Parts List

C1,C2,C3,C4	0.0047 µF disc
C5	1200 µF, 200 V electrolytic
C6,C7,C26	0.01 µF disc
C8	0.02 µF, 500 V disc
C9	47 µF, 35 V electrolytic
C10,C11	200 pF silvered mica
C12	590 pF silvered mica
C13	750 pF silvered mica
C14	300 pF silvered mica
C15,C16	Large 270 pF silvered mica
C17	Hammarlund MC-505 or MC-20-SX
C18,C19	10 pF, 1 kV ceramic disc
C20	220 µF, 16 V electrolytic
C21	0.047 µF, 500 V disc
C22	0.1 µF, 100 V mylar
C23,C24	0.0022 µF, 1 kV disc
D1	1N4746 zener
D2,D5	1N914
D3	1N4747 zener
D4	1N4735 zener
F1	1 amp 3AG slow blow fuse
F2	1/2 amp 3AG fast blow fuse
J1,J3	UHF jacks
J2	Red pin jack
K1	5 V SPDT relay (Archer 275-243)
L1	8 turns #22 on Amidon T32-6 core
L2	10 turns #22 on Amidon T37-6 core
L3	11 turns #22 on Amidon T37-6 core
LED1	Red LED
M1	100 µA, 1/14"-square meter (DI-935)
NE-2	NE-2 neon bulb
Q1,Q2	Supertex VN0660N5 MOSFETs
Bridge	600 V, 6 A bridge rectifier
R1,R25	Keystone CL-60 10 ohm inrush limiter
R2	50 ohm, 10 watt, wire-wound
R3	6000 ohm, 10 watt, wire-wound
R4	390 ohm, 1/2 W, 5%
R5	68 ohm, 1/4 W, 5%
R6	82k, 1/4 W, 5%
R7	47k, 1/4 W, 5%
R8,R9,R11,R16	15k, 1/4 W, 5%
R10	47k, 2 W, 5%, carbon
R12,R17	10k, 10-turn trimpot (board-mounted)
R13,R18	22k, 1/4 W, 5%
R14,R15	6.8 ohm, 1 W, 5%, carbon
R19	47 ohm, 2 W, 5%, carbon
R20	27 ohm, 2 W, 5%, carbon
R21	15 ohm, 5 W wire-wound
R22	270 ohm, 1/4 W, 5%
R23,R24	1.8 ohm, 1/2 W, 5%
RFC1,RFC2,RFC3	100 µH, 2 amp (Archer 273-102A)
RFC4	ST #22 spaced full length on 47k, 1 W carbon resistor
S1	DPDT rocker switch (Archer 275-691)
S2	Small DPDT rocker switch
SCR	6A, 400 V (Archer 276-1020) 25 mA trigger
T1	10 turns #20 center-tapped on Amidon T68-6 core Link is two turns #22 Teflon-insulated hook-up wire
T2	14 turns #24 center-tapped on Amidon T37-6 core Link is 8 turns #24 Teflon tubing
Case	4" x 6" plastic card file box
Panel and chassis	1/10"-thick sheet Bakelite, fastened together with Lucite block

The Octopus

A simple multipurpose testing device.

by Craig Faith KB5RMZ

Everyone likes to save time and effort, and amateurs are certainly no exception. This little circuit has become invaluable around my shack when the need arises to do some quick troubleshooting.

It's called an "octopus," an obvious name once you see one hooked up in all its tangled-cable glory, and is available commercially in varying degrees of complexity and price. This is the simplest version I have found, and it was sketched out for me by some shipmates in AIMD, while serving aboard *USS Forrestal* in 1977. Its main attraction is the ability to quickly test a wide range of components and conditions, without changing switches or test instruments.

The unit is designed to be used with an oscilloscope. Any scope will do, as long as it has provision for an external horizontal input. We aren't going to be concerned with precise measurements, so anything from a $10 flea market special to a thousand-dollar Tek will deliver good results.

The Circuit

The circuit is shown in Figure 1. Resistors can be anything from 1/2 watt to 2 watts, and from 1% to 10% tolerance. The transformer can be any 6.3-volt AC unit. Construction is not critical. The unit can be built into a variety of enclosures, and could even be built into some of the older, large-case scopes. Please remember safe construction practices—no exposed 120-volt AC connections, and fuse the primary side with no more than a 1/2-amp fuse. Use shielded coax for the connections to the channel 1 and external horizontal inputs. RG-62 works very well for this.

With everything hooked up and turned on, and the "+" and "-" test probes not touching, you should be able to adjust the scope for a horizontal straight-line display, extending across half to three-quarters of the screen for ease of viewing. Now, shorting the test probes should give a vertical straight-line display, also extending half to three-quarters of the screen. If not, find and correct the problem.

Test Applications

After testing for proper operation, it's time to put the unit to use. The octopus is a "shotgun" test instrument, used to rapidly test for obvious, simple problems as follows.

Continuity: Touching the probes to a suspect fuse, wire, or other normally shorted circuit should result in a vertical line. Shorted components, such as semiconductors, will also produce a vertical line. Blown fuses, diodes, etc., will cause the trace to stay horizontal.

Resistance: It's possible to test for a moderate amount of resistance with the unit. Pure resistance will display as a line at some angle between 0 and 90 degrees. A high enough resistance will show as an open circuit. Precise measurements are not possible—but we don't care. A 20-ohm resistor should produce a nice slanted line. If it doesn't, drag out an ohmmeter for a closer look.

Capacitance: Our octopus can also test capacitors—again, up to a point. A good low- to medium-value cap will show up as a circle or an oval, depending on the value. Any imperfections in the circular display are indications of a bad or leaking capacitor. Refer to Figure 2A for an idea of what the trace should be, for resistance or capacitance.

Semiconductors: Now we come to the unit's most important use, the area where it really shines. In this age of solid-state everything, a quick and easy way to test semiconductors can save a considerable amount of time. We covered testing for shorts or opens in

Continued on page 57

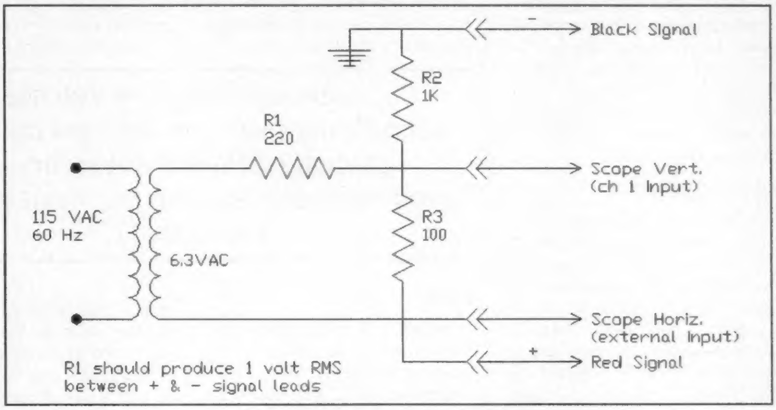

Figure 1. The "octopus" circuit.

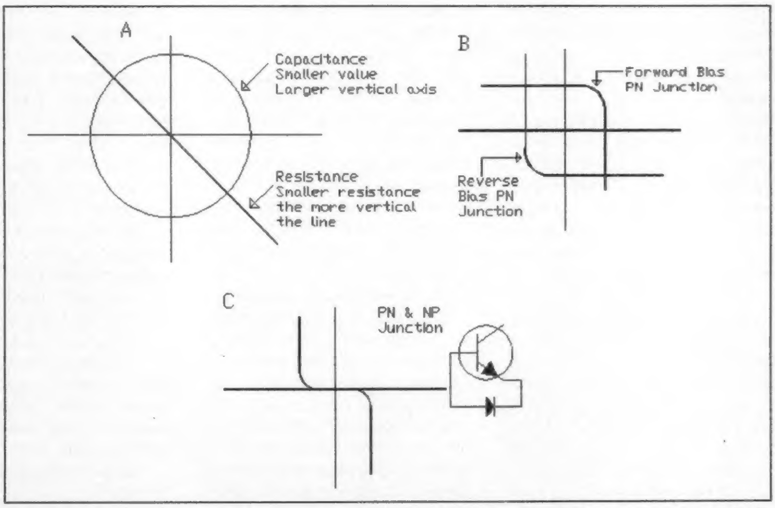

Figure 2. A) Trace for capacitance and resistance. B) Basic semiconductor junction. C) Indication of a simple compound waveform.

Number 17 on your Feedback card

ASK KABOOM

Your Tech Answer Man

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Wrap Up And Move On

For the past couple of months, we've been looking at the issue of taking measurements, examining the proper use of both meters and the oscilloscope. Let's finish that up.

The Mighty Scope

I've written about the details of scope use before, but a few points bear repeating. First, always remember that what you see on the screen is only a snapshot of a tiny slice in time. Without an infinitely long screen, there's no way you can see a continuous signal. Instead, you see a little fraction of it, repeated over and over for your viewing pleasure. The consequence is that, depending on how you set the scope's controls, you can get pictures of vastly different appearance, even without changing the input signal! Why is that?

Let's Go Cycling

Most signals are repetitive. That is, they have regular cycles, repeating the same waveform over and over, with the only changes being the signals' modulation. That's lucky for us: If they didn't repeat, signals would be darned near impossible to view on a scope. In order for the CRT's beam to trace out an image bright enough to view, it has to hit the same spots over and over. Although many scopes do have "single-shot" trigger settings that let you observe one-time events, they are rarely useful unless the signal and your timebase settings are very slow; you just don't get a bright enough picture if the beam zips across the screen. In a way, you can look at it as a duty cycle issue; you need a small ratio between the timebase setting and the repetition rate of the signal, or too much time passes between sweeps and the phosphor glow dies out.

With a simple signal like a sine wave, the effect of changing the scope's timebase is obvious: Make it faster and the wave stretches out. Slower, and it gets squished together. With a complex signal, though, properly setting the controls can be a confusing process. One of the best examples is a good ol' video signal. If you've messed with ATV, you've probably needed to look at video. Most likely, you had great trouble getting your scope to trigger on the vertical sync pulse. Why? Because the duty cycle is very low; you get one vertical sync pulse for every 262.5 horizontal ones. Also, the vertical pulse is really just a shifting of the duty cycle of the horizontal pulses, making it especially hard to lock onto. Probably, though, you found it easy to lock up to the horizontal pulses. The point here is that, depending on which pulses you chose to lock to, you saw a vastly different depiction of what video looks like! If you've never tried this, get your camcorder and scope, and experiment.

Luckily, most radio signals are usually easier to view, thanks to their simple, cyclical nature. But, with the digital explosion, you may run into long, complex pulse trains which just can't be viewed on a scope. They have special instruments called logic analyzers for that kind of work.

> ***". . . depending on how you set the scope's controls, you can get pictures of vastly different appearance, even without changing the input signal! Why is that?"***

Hold It!

Speaking of digital, there's one place in which it can really come to your aid. Digital storage oscilloscopes, or DSOs, get around the repetition problem by digitizing and then storing the incoming signal in solid-state memory. Then, they convert the signal back to analog and output it continuously to the scope's CRT. With a DSO, you can freeze and view even true single events with ease. Many DSOs also let you save the waveform data to a computer. Some even store multiple waveform captures and let you put them up together for comparison on the screen, even though they were not harmonically related. That's something no analog scope can do.

There are limitations to digital scopes, most involving the sampling rate and something called "aliasing," which can fool you into thinking you are seeing something you're not. But, there's no point in my going to great lengths discussing the finer points of DSO operation, because digital scopes are still pretty expensive and consequently rare in ham circles. A few years from now, though, that may not be the case. I hope DSOs become affordable, because I want one!

Frequency

In the old days, all kinds of arcane instruments and techniques were employed to measure frequency, which is not a simple quantity like voltage or resistance. Frequency is, for lack of a better word, a compound measurement, like speed (distance over time). We say "miles per hour" instead of "mours" or "hiles" because there's no simple unit. With frequency, it's cycles per some period of time. We say "Hertz" to honor a great pioneer in this field, but the compound nature of the beast remains, making its measurement more difficult. These days, though, the digital frequency counter has swept all the old stuff away, and with good reason; it's easy to use and stays pretty well calibrated, thanks to its using a quartz crystal as a reference. But, how truthful is your counter?

That depends on the unit itself and how you use it. Any counter is only as accurate as its timebase crystal. Unfortunately, lots of low-priced counters display many digits whose precision far outstrips the basic accuracy of the timebase. So, you may get eight digits, but the last five may not be correct! When you're looking at a nice digital display, though, it can be hard to remember that. We tend to trust what our machines tell us, and many a radio has been misaligned by a well-intentioned technician who, wanting to squeeze the last bit of perfection from it, depended on a highly precise counter that wasn't accurate. The moral is: If your walkie reads 200 Hz low at 146 MHz, *leave it alone!* There's nothing wrong with your walkie, and your counter is probably not telling you the truth. Besides, even if the radio really is 200 Hz low, that's well within spec and will cause no trouble. Of course, if it reads 2 kHz low, that's another story, and one which leaves you with a dilemma; which one is right? Hmmm, no easy answer there, except to get another radio or two and measure them. If they all come out about the same, I'd look sideways at that counter. On the other hand, if they read very close to the right frequency, your HT probably does need adjustment.

Most counters let you select from a couple of measurement periods. The longer the period you choose, the more precision you'll get, in the form of more digits. As long as you understand the precision vs. accuracy issue, you can use that to your advantage. Just don't believe those last couple of digits unless you know the accuracy of the timebase supports them.

Two other issues affect counter accuracy: signal level and noise. Theoretically, the level shouldn't have any effect at all; as long as the signal trips the input stage of the counter, you should get a correct reading, within the limitations of the instrument. I haven't found that to be completely true, however. In my experience, too low a level allows little signal modulations from hum or noise to cause the tripping of the input stage to be intermittent, as the signal dips and rises around the threshold level of the instrument. The result is that you may see a slightly lower frequency than you expect, which could lead you in the wrong direction. Remember, a counter only records how many times its input is tripped during the measurement period; if some pulses are missing, it doesn't know that. I've run into this many times with low-level crystal oscillators. The tip-off is that the less significant digits wander around; especially with a crystal-generated signal, they should stay put pretty well, with perhaps only the last one wandering a little bit.

Noise can have just the opposite effect. If it's strong enough, it can add extra trips, resulting in counts that are too high. The clue's the same, though: the reading wanders. See, even counters can get messy!

Reactance

There are various devices to measure capacitance and inductance. Some come built into digital meters, and there are meters made just for the purpose. You can also get inexpensive kits that convert those reactances to a voltage readable on a voltmeter. Pretty much all the schemes rely on oscillators or flip-flops whose time periods are altered by the unknown quantities and then integrated into a voltage. The technique works very well, but the analog nature of the process suggests that it isn't as accurate or stable as a direct measurement of voltage, which concentrates all the accuracy in one state: the A/D converter. Of course, if the oscillator is very stable, accuracy should be quite good.

Well, there are other kinds of measuring devices, from dip meters to bridges to transistor gain testers to spectrum analyzers. But I think that we've covered most of what you're likely to use on a frequent basis. I hope you've enjoyed this topic. Next time, something different! Until then, 73 from KB1UM.

Octopus

Continued from page 55

continuity, but we can do much more with solid-state devices. Touching the leads across a diode or any two legs of a transistor results in a display similar to that of Figure 2B. This is a representation of a basic semiconductor junction. As with the capacitor display, any interruption in the smooth curve indicates a problem with the device being tested. Unknown and grab-bag components can also be identified as "P" or "N" types by observing the direction the junction breaks. Finally, it is possible to do rough matching of transistors by matching the displayed curves.

Doing in-circuit testing can result in some fairly complex waveforms being displayed. This is especially true if there are ICs in the circuit under test. Opening up a leg of the circuit to isolate the component under test is sometimes the only way to get a good reading.

The best way to learn about and become familiar with the unit is to play with it. Get a handful of known good parts and test them, observing the traces that each generates. Get some scrap printed circuit boards and start poking around. Figure 2C shows an indication of a simple compound waveform that can occur with multiple components when testing in-circuit. You can even try reading integrated circuits with it—depending on the chip, some fairly complex waveforms can result.

I would caution against trying to measure such things as MOSFETs, GaAsFETs, or IGFETs. These are very sensitive devices, and even the approximately 1 volt AC that the octopus uses for its tests might be too much for them.

I hope this little gadget proves to be as useful, and as much fun, for you as it has been for me. Again, the important point is to use it. With use you'll discover even more ways to save time and effort, time better spent on the air rather than in the radio.

Note: With the 220-ohm resistor at R1, the voltage across the test leads is closer to 2 volts AC. This is acceptable, but a value of approximately 680 ohms will drop it to the 1-volt level.

Originally printed in the Arkansas Regional Club Newsletter.

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Low-Voltage DC Power Supplies II

Here we go again, continuing our discussion of low-voltage, low-current DC power supplies. These supplies are used for the wide array of gidgets and gadgets that hang around ham shacks and SWL listening posts, as well as electronic hobbyist workbenches. In this month's installment, we will look at the circuit for a variable output DC voltage regulator, and some primary switching circuits for the input end of the power supply.

Variable Output Voltage Regulator

The voltage regulators that we looked at last month were fixed output devices. They have one output voltage, and are not adjustable for other voltages (although certain circuit tricks can modify the output voltages, they are not recommended). However, the LM-317 and LM-338 devices are useful for a variable output voltage regulator. Figure 1 shows the circuit for both forms of voltage regulator.

The key features of this circuit are the same as for the previous circuit: C1 is the filter capacitor, and should be rated at 2,000 µF/ampere; C2 is used to prevent noise problems and smooth some output variation; diode D1 is used to snub any substrate-damaging dumps from C2 or the external circuitry.

The output voltage is set by resistor voltage divider R1 and R2. The voltage will be:

$$V_o = 1.26 \times [R2/R1 + 1]$$

With the values shown, the output voltage will vary from 1.26 volts to 36 volts, as R2 is varied from 0 to 5,000 ohms. If R2 is made a multiturn precision potentiometer, then it's possible to set the output voltage to a very small tolerance of a desired value.

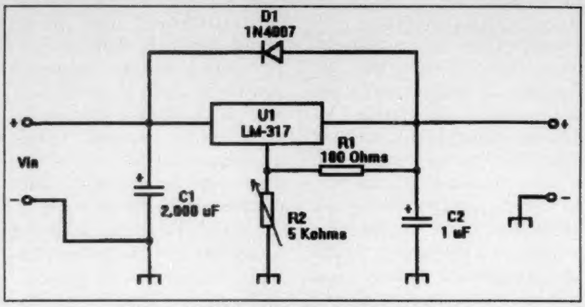

Figure 1. Variable output voltage regulator circuit.

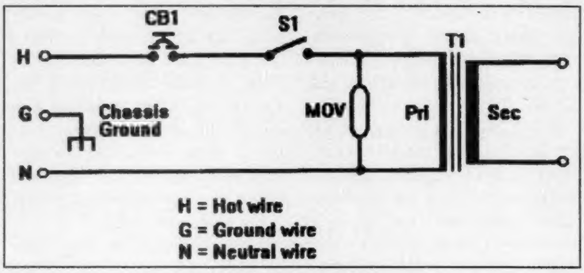

Figure 2. Simplest primary switching circuit.

Switching Schemes

Switching is used to control the input of the DC power supply. After all, some means is needed to turn it on and off (marvelous statement of the obvious!). Figure 2 shows the minimum switching that's necessary: Switch S1 is a single-pole-single-throw (SPST) switch in series with the hot side of the AC power line. A fuse or circuit breaker (CB1) is used in series with the switch. Its function is to open the circuit in case of a catastrophic fault (like a short circuit).

The MOV device is optional, but it's highly recommended. It is a *metal oxide varistor,* and is used to snub out high-voltage, short-duration transients on the AC power line. These are the devices that are used inside those special outlet strips used with personal computers. Residential power lines see transients of 2,000 volts peak, at durations up to 20 µs, several times a day. That's a lot of *stresssssss* on DC power supply components, and could interfere with the operation of circuits (especially digital circuits).

The switching scheme shown in Figure 2 is not the best solution, in my opinion. The problem is that it opens only one side of the AC power line. Hopefully, the hot side is opened . . . but that's not always true. Why? Because AC plugs are often inserted into the outlets backwards, and houses are sometimes miswired (a friend of mine had an apartment that was wired with the switch in the neutral line!). A better scheme is shown in Figure 3. This circuit uses a double-pole-single-throw (DPST) switch to open both sides of the AC power line simultaneously. As a practical matter, you may have to use a double-pole-double-throw (DPDT) switch, but they are easily available.

A relay switched scheme is shown in Figure 4. In this circuit, the two "switches" in series with each side of the AC power line are actualy contact pairs on an electromechanical relay. When the coil of the relay (K1) is energized, it becomes a magnet and pulls the switch contacts closed. Switch S1 is in series with the coil of relay K1, and the S1/K1 pair are connected across the AC power lines. When S1 is closed, relay K1 is energized and the contacts close to apply power to the transformer primary winding. Neat, huh? This circuit can be used to remote control (by wire) the on/off function, or when the transformer primary current is higher than a small, conveniently available switch can handle.

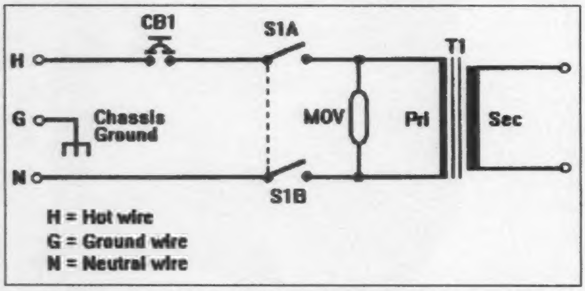

Figure 3. Better switching scheme.

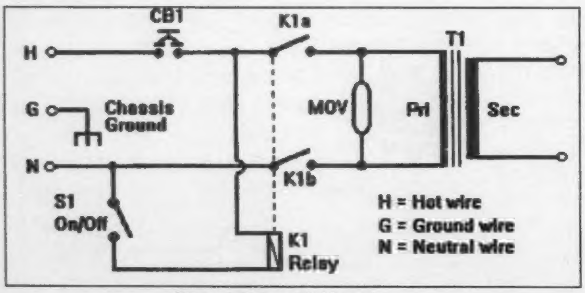

Figure 4. Relay switching scheme.

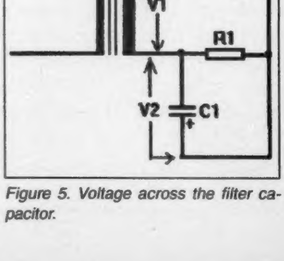

Figure 5. Voltage across the filter capacitor.

Filter Capacitor Ratings

The ripple filter in a DC power supply is used to smooth the pulsating DC from the output of the rectifier into something resembling the "pure" DC needed by electronic circuits. These capacitors tend to have high values. For example, in low-voltage DC power supplies the values tend to be 470 to 5,000 µF. In high-voltage DC power supplies, values tend to 8 to 100 µF. These capacitors can store quite a charge.

Capacitors also have a working voltage rating (WVDC). This voltage is marked on the capacitor, and must be heeded. The best practice is to allow a tolerance for variation in applied voltage as well as variation in the real, as opposed to marked, voltage rating.

At one time I worked at a major hospital servicing medical equipment. One brand of bedside patient monitor had a reliability problem with some 60-µF/350 WVDC filter capacitors in a ±200-volt regulated DC power supply. The voltage applied to the regulator was nominally 270 volts, plus or minus 15 percent. This means that the actual voltage could vary over the range 230 to 310 volts. The filter capacitors used were a rather shabby component that had a ±20-percent tolerance on the working voltage. That means the *actual* working voltage rating could be as low as 280 volts. Was the design engineer missing something? That filter capacitor could be hit with a voltage that was 30 volts over its actual rating! The symptom seen, over and over, was either shorted filter capacitors or swollen bodies that indicated a fault in the near future. When we started using 60-µF/450-WVDC capacitors instead, the reliability problem went away. Because of that experience, and the fact that the equipment was

Number 19 on your Feedback card

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
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Baltimore MD 21200

A few months ago, I sidestepped a question about using sound boards in your desktop computer for processing RTTY signals. Well, from Alain Bourassa VE2MTV comes the following reply, via Internet:

"I was just reading your June 'RTTY Loop.' I know of those software packages for RTTY, AMTOR, PACTOR, and even packet at 1,200 and 9,600 baud with a sound card. The first thing to know is that those software programs were not written for a Sound Blaster card (the Creative Labs original). They are written for the Cardinal DSP 16 and a few other Cardinal compatible sound boards like the Beethoven DSP.

"This card (the Cardinal board) is Sound Blaster-compatible as well, and this is where the confusion comes from. I bought mine locally for $140 Canadian, which could put the cost in the USA at around $70 to $80. This card is not hard to get, but most of the time you have to ask for it, and a vendor will order it for you. It's not the kind of sound card that many dealers keep in stock for regular customers.

"Those sound boards are all equipped with an AMD DSP chip, and Cardinal just asks $39.00 for their software development kit, compared to over $400 for the same kind of kit from Creative Labs. It's easy to understand why Cardinal, even if not as renowned for their sound boards, is the favorite for the software developers.

"It's easy to understand why Cardinal, even if not as renowned for their sound boards, is the favorite for the software developers."

"The easiest file to find is called PSATOR. This is PACTOR software written by an American ham. I also have a packet driver written to be used in JNOS with an 'attach' command that will let the Cardinal DSP 16 act like a DRSI packet board at 1,200 and/or 9,600 baud. This driver was written by a Swiss ham. I also have seen the DSP voice software and a software package for decoding HF WEFAX with a real Sound Blaster (Pro or 16ASP)."

A variety of programs are available for experimentation all over the Internet. One such program, PSATOOL1.ZIP, is included on the latest edition of the "RTTY Loop" software collection. This is a Cardinal Sound Card (PSA) toolkit, written by Johan Forrer, KC7WW. It contains an updated PSA toolkit as described in "An Adaptive HF DSP Modem for 100 and 200 Baud," *QEX*, November 1994:

SPASM21.EXE—Public domain 21xx assembler (updated);
CLOAD.EXE—Bootstrap formatter;
PSA1.OBJ—Object modules for writing your own "C";
PSA2.OBJ—language applications (large model only);
PSA.H—Header file required to compile "C" applications.

As mentioned above, the complete program, PSATOR, is also available on the latest "RTTY Loop" disk as PSATOR10.ZIP Version Beta 0.10, which replaces beta 0.09A, dated 7/11/94. It enables both AMTOR and PACTOR using a PC DSP sound card. The package contains software for using the DSP chip on a PC sound card to implement an HF DSP modem. This software will only run on PSA-based sound cards. The PSA sound cards contain a three-chip set from Analog Devices that includes an ADSP2115 DSP, memory, and a CD-quality 16-bit A/D-D/A. There are several manufacturers for such cards: Cardinal Pro 16 (and Pro 16 Plus), Orchid Soundwave 32, Western Digital Paradise 16-DSP, Wearnes Beethoven, and Echo Speech. Johan Forrer KC7WW has developed this software and placed it online for amateur use.

Overall, these packages, and others available online, allow one to implement a variety of communication modes through advanced hardware and software techniques. I would be interested in hearing of your experiences with this pathway.

Having addressed one problem, let's see if you all can help out with another one. Arthur F. Jeyes AA3GU sent along the following question:

"Hi. I read your features in *73* magazine, and was wondering if you can give me some help. I use a KAM Plus and an MFJ-1278B for digital communications. However, in an effort to achieve better performance I would like to use a dedicated terminal unit (TU). I have purchased an IRL FSK-1000 (used) and am attempting to hook it up to my Kenwood TS-850 at this time. The information that I have is conflicting, at best. Some information on hookups was included with BMK-MULTY, and other information was included with the FSK-1000. But I can't seem to find a definitive guide to setting up strapping and interconnects to radio/PC. In addition, the FSK-1000 has a daughter board that is not documented in the manual that I have, although it appears to be a factory-installed option.

"Any help you could offer would be greatly appreciated . . ."

I seem to remember a daughter board on an IRL demodulator I had some years back, Art, and it may just represent a factory-installed upgrade. However, I will back off and see if any of the readership have experience with this combination. Your equipment is not that aberrant, though, and I wouldn't doubt at all that someone else may be using a setup similar to yours. Sit tight, and let's see what comes in.

I received a letter from Dr. Anil Kumar Agarwal VU2TRI at the Medical Amateur Radio Society, Agra, India, in which he describes their small ham radio club in the local medical college. With a 386SX computer and several simple programs, they are still unable to copy RTTY with their setup. Anil is looking for some RTTY frequencies for monitoring, simple software, and some kind of club project for a RTTY station.

Well, hopefully, the Baycom schematic printed here a bit ago (June 1995, p. 69) will help meet the desire for a simple home-brew circuit. Many, many folks are using the Baycom package, the software for which is part of the "RTTY Loop" disk collection. A simple, TU-less design, Baycom may be your best bet for a straightforward club project.

While I have sent much of this material to Anil, I will say again for those just arriving, that amateur RTTY may be heard most commonly at or around 3,620 kHz and 14.080 MHz. Commercial RTTY is rarely Baudot, so listening to that is a hit or miss proposition.

I've mentioned the "RTTY Loop" disk collection several times above. Again, for newbies to the "Loop," this is a series of more than ten disks with a variety of programs of interest to the digitally inclined ham. A full list of programs, now including a one-line description of each program, may be yours for a self-addressed, stamped envelope to the above snailmail address, or an E-mail request to one of the E-mail addresses below. The full details of how to obtain the disks is included with the listing. Your comments, questions, and answers to my questions are also solicited. Address me electronically at 75036,2501 on CompuServe, at MarcWA3AJR on Delphi, also at MarcWA3AJR on America Online, and via my preferred Internet address at MarcWA3AJR@aol.com.

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critical to the patients being served, I developed a preference for the practice of selecting a WVDC rating that is at least 40 percent over the maximum probable voltage that will appear across it.

Safety First

When working on DC power supplies, you may be exposed to high AC or DC potentials that can kill you. In addition, the filter capacitors may retain a charge even after the equipment is turned off. Be very careful around circuits, and don't work them "hot."

One problem with many AC-operated power supplies is that the AC power mains are ground referenced at the service entrance to the house. This means that if you accidentally touch the hot side of the AC power line while grounded, you get the full—potentially lethal—whack! In order to prevent problems like that, I use an isolation transformer on my workbench. These transformers are 1:1 ratio, so will produce 110 volts output when the input is 110 volts. Models are available that have a line cord on the primary side, and a three-pin standard AC output on the secondary side. The volt-ampere (i.e., watts, more or less) rating will let you know how much power can be drawn from the transformer. I use a 2,000-VA (2-kVA) model to power everything on the workbench. I was lucky . . . my isolation transformer was industrial surplus and appeared at a very good price on the shelves of a local electronics distributer (2,000-VA isolation transformers can be pricey, but they can save your life!).

Rectifier Ratings

Figure 5 shows a half-wave rectifier (for simplicity's sake) and a ripple filter, redrawn to allow us to see that the voltage across the capacitor is in series with the secondary voltage of the transformer secondary. On the first positive half cycle, capacitor C1 is charged to very close to the peak voltage provided by the transformer. On the next half cycle, when V1 is negative (reverse biasing the diode), this voltage is in series with V1 (the capacitor voltage). At the AC peak, therefore, the series combination applied to the rectifier is twice the peak AC voltage. Or, in terms of RMS voltage (which is how the transformer's secondary voltage is rated), the series combination of V1 + V2, which reverse biases the diode, is $2 \times 1.414\ V_{RMS}$, or $2.83\ V_{RMS}$. If you have a 12.6-volt RMS transformer, then, the voltage applied to the rectifier as a reverse bias is 35.7 volts. A diode with a 50-volt PIV rating is a little marginal in this application because the variation of the AC power line can push it up to 50 volts. That's why I would use a 100-volt PIV diode (or higher!). In fact, I tend to use 1N4007 (1,000-volt PIV) for all low-voltage applications (besides, they are cheap in bulk).

Number 20 on your Feedback card

HAMS WITH CLASS

Carole Perry WB2MGP
Media Mentors Inc.
Staten Island NY 10313-0006

It was with the greatest of pride that I introduced the young adults who were this year's speakers at the Dayton HamVention Youth Forum. Each year young people from all across the country (and some from other countries, too) begin getting in touch with me as early as the summertime to be interviewed for the Youth Forum. Although I never like to turn anyone down, it *is* an encouraging sign that many more children have been applying than there are slots available.

Preparing for a successful youth forum the magnitude of the one at Dayton, is a job that requires a great deal of time and effort, starting nine months prior to the event. If you and/or your local ham radio club plan to have a youth forum at a hamfest or other ham radio gathering, you might want to give me a call for some tips that will save you much time.

The children I selected this year each spoke about different aspects of ham radio. I chose children who represented a variety of interests and backgrounds. They were all wonderful! It takes a lot of courage for a young person to get up in a room filled with adults as well as their own peers and deliver a 10-minute speech.

The first up to the podium was Marc Azar N2XEZ from Tom's River, New Jersey. Marc and his dad are both active in ARES. He is 14 years old and enjoys doing emergency communications.

Stefnee Lindberg N0ONP is 18 years old with an advanced ticket. She is from Kansas City, Missouri, where her extraordinary work with the Red Cross was documented on a local television show. Stefnee is visually impaired and easily impressed the audience with her determination and enthusiasm. She gave a nice talk entitled "Reasons For Becoming A Ham."

Missy Hollenbeck AA0OF from the Kansas Andover Middle School is a teacher who brought three of her ham radio students with her to the Youth Forum. The day before, Missy was a speaker at my Instructors' Forum where she gave an outstanding presentation. The three youngsters, Sarah Hill AA0TN (age 15), John Dolecek KB0LHG (age 14), and Donovan Metcalf N0UYW (age 15), had along with Missy prepared a delightful 30-minute skit. When the apron and pots and pans came out for a take-off on the SOS commercial on TV, we all knew we were in for a treat.

When each of the three children got to the microphone, he or she spoke about their most exciting adventures in Missy's classes, including Field Day, balloon launching with a cricket on board, packet radio, and lots more. We were trying a new format by letting the teacher be involved in the children's presentation. It was terrific!

Robbie Mehls KB0MAS is 13 years old and is treasurer of the Boulder Amateur Radio Club (BARC Jr.) in Colorado. Robbie was recommended to me by Ellie and Rip Van Winkle, who are two of the elmers doing an outstanding job with children in ham radio. Ellie N0QCX has supplied me with excellent BARC Jr. speakers for the past three years, and is a good example of the influence a teacher can have on the lives of her students.

Robbie was an outstanding representative of his club. His slide presentation of an outing his group went on into the Canyonlands of Colorado was breathtaking. The emphasis of his talk, of course, was on the role of ham radio emergency communications when danger arose. It was an excellent presentation.

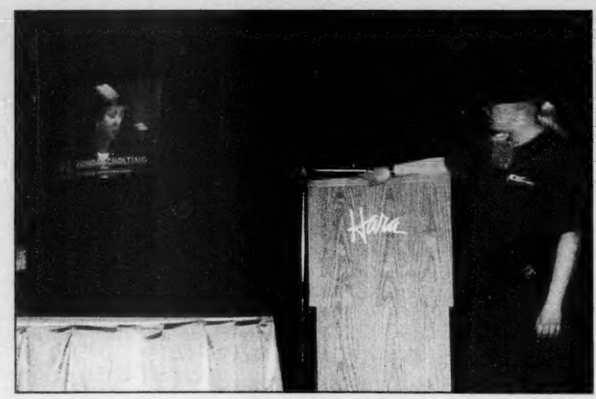

Photo A. Eighteen-year-old Stefnee Lindberg N0ONP shows video of her TV coverage.

Don LaFreniere VA3DJL, 16 years old, is from Ontario, Canada. He is the coordinator for his club's ARES net. Don had the group smiling and laughing as he described his search for a radio club composed of other youngsters, but wound up joining the "Retirees" club. His great sense of humor, the video footage of his club activities combined with a musical background, and a description of his accomplishments all made for a wonderful presentation.

Allison Zettwock KD4CKP is 15 years old with an Advanced ticket. She is from Louisville, Kentucky, and was the Westlink-YAESU Young Ham of the Year. Allison spoke about her work with the Girl Scouts, and her aggressive efforts in recruiting other kids. This well-rounded young lady was a delight to listen to.

The next speaker was one of the young people influenced by Allison, Daniel Sturgeon KE4KXB, 17 years old and from Louisville, Kentucky. Daniel is actively recruiting other children by working through the Boy Scouts. He has international amateur radio interests that led him to winning a congressional scholarship to go to Germany to study next year. I made Daniel promise to stay in touch with me about his adventures overseas. We all wish him the best.

Three of the manufacturers were well represented at the Youth Forum, where they generously donated rigs to three lucky youngsters in the audience. Maria Lopez from Kenwood presented Michael Macino KB9IHS with a 22AT rig. Richard Stubbs KC5NSZ, the customer service manager of MFJ, presented Ryan Southwell KE4GEN with a 20 meter SSB TravelRadio. Derek Wyatt, a young man who is now highly motivated to get his license, was the winner of an Icom 2 meter T21A HT. Chris Lougee presented the rig on behalf of Icom. Let's all remember to support the manufacturers who lend their support to education and young people.

It was once again a great privilege for me to be part of the forum that showcases the accomplishments and radio achievements of young hams.

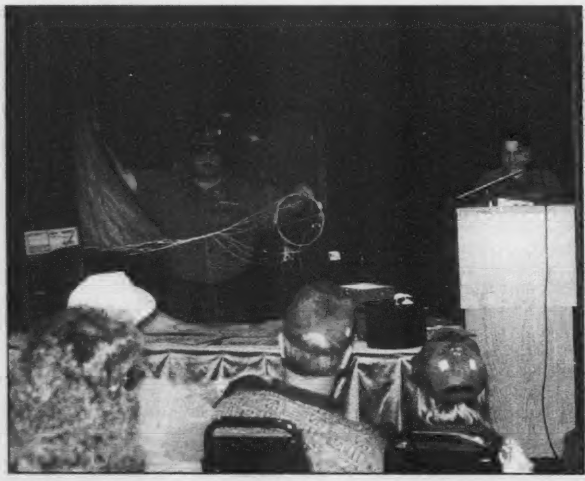

Photo B. The group from Andover Middle School did a lively demonstration of their balloon launch.

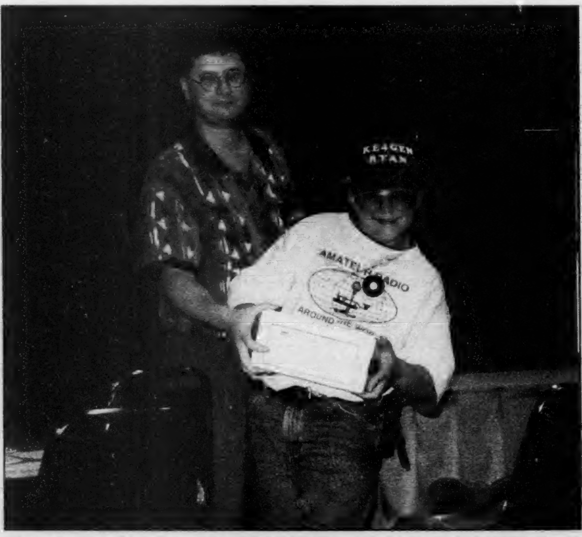

Photo C. Richard Stubbs KC5NSZ from MFJ presents a 20 meter SSB TravelRadio to Ryan Southwell KE4GEN.

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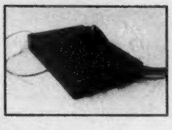

Ramsey breaks the price barrier on FM rigs! The FX is ideal for shack, portable or mobile. The wide frequency coverage and programmable repeater splits makes the FX the perfect rig for Amateur, CAP or MARS applications. Packeteers really appreciate the dedicated packet port, "TRUE-FM" signal and almost instant T/R switching. High speed packet? ...No problem. Twelve diode programmed channels. 5W RF output, sensitive dual conversion receiver and proven EASY assembly. Why pay more for a used foreign rig when you can have one AMERICAN MADE (by you) for less. Comes complete less case and speaker mike. Order our matching case and knob set for that pro look.

FX-50 kit (6 Meters)	$149.95	FX-146 kit (2 Meters)	$149.95
FX-223 kit (1 1/4 Meters)	$149.95	FX-440 kit (3/4 Meters)	$169.96
CFX matching case set	$29.95	FXM-1, ICOM/Yaesu style speaker mike	$29.95

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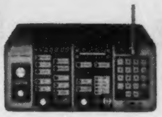

COM-3. the world's most popular low-cost service monitor. For shops big or small, the COM-3 delivers advanced capabilities for a fantastic price—and our new lease program allows you to own a COM-3 for less than $3.00 a day. Features • Direct entry keyboard with programmable memory • Audio & transmitter frequency counter • LED bar graph frequency/error deviation display • 0.1-10.000 µV output levels • High receive sensitivity, less than 5 µV • 100 kHz to 999.9995 MHz • Continuous frequency coverage • Transmit protection, up to 100 watts • CTS tone encoder • 1 KHz and external modulation.

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Here's a great booster for any 2 meter or 220 MHz hand-held unit. These power boosters deliver over 30 watts of output, allowing you to hit the repeater's full quieting while the low noise preamp remarkably improves reception. Ramsey Electronics has sold thousands of 2 meter amp kits, but now we offer completely wired and tested 2 meter, as well as 220 MHz units. Both have all the features of the high-priced boosters at a fraction of the cost.

PA-10 2 MTR POWER BOOSTER (10 X power gain) Fully wired & tested	$99.95
PA-20 220 MHz POWER BOOSTER (8 X power gain) Fully wired & tested	$99.95

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Locate hidden or unknown transmitters fast. The Foxhound direction finder connects to the antenna and speaker jack on any radio receiver, AM or FM from 1 MHz to 1 GHz. The antenna (a pair of dipole telescopic whips) is rotated until the Null meter shows a minimum. A pair of LEDs indicate to turn Left or Right. The Foxhound is ideal to use with a walkie-talkie. if you wish to transmit, go ahead, a built-in T/R switch senses any transmitted RF and switches itself out of circuit while you talk. It doesn't get any easier than this! We provide all parts except for a few feet of 1/2 inch PVC pipe avialable at any hardwar e store for a dollar or two. Add our matching case set for a complete finished unit. Be the one with the answers, win those transmitter hunts and track down those jammers, you'll do it all with your Foxhound.

Add some fun to your club events by having a transmitter hunt! Foxhunting is a craze sweeping the nation, but many clubs are missing out on the action because they lack the expertise or time to develop their own foxhunt transmitter. We set one of our most devious and sneaky engineers to the task of designing an easy to build and use, yet highly capable Foxhunt transmitter. A snazzy microprocessor controller has both preset and programmable transmission characteristics allowing you to easily set the difficulty level from "beginner" to "know-it-all"! The SlyFox, FHT-1, is crystal controlled in the 2 meter band (crystal for 146.52 included) with a power output of 5 watts that is adjustable by the controller.The transmitter is programmed to ID in CW or add our voice option if you really want to aggravate the troops - "Ha ha, you can't find me!" Join the fun, get rid of those stuffy old meetings and picnics. have a foxhunt!

DF-1 Foxhound direction finder kit	$59.95	CDF Matching case set for DF-1	$14.95
FHT-1 SlyFox Foxhunt transmitter kit	$129.95	FHID-1 Voice ID option	$29.95
CFHT Heavy duty metal matching case set for FH T-1	$29.95		

SX-20 20 METER SSB/CW TRANSCEIVER

Finally, a handy go anywhere rig that puts the fun back into ham radio. How about the DDS synthesizer that tunes in 10 Hz steps with exceptionally low noise for weak signal reception. Or, how about the built-in Iambic CW keyer that has a digital readout of your CW speed. Perky 10 watt RF output (that's only 11/2S units below a 100 watt rig!) can be tuned down for true QRP operation. Included with the SX-20 is the hand mike with handy UP/DOWN buttons for remote tuning of the rig while driving — or biking — or boating. Available in both fully assembled and fun to build kit form, you'll find that the SX-20 will become your favorite rig.

SX-20 20 meter SSB/CW Transceiver, fully wired, 1 yr. warranty			$429.95
SX-20 20 meter SSB/CW Transceiver Kit Form			$349.95
Optional CW Audio Filter SXCWN WT	$49.95	Kit	$39.95

PACKET RADIO

Two new versions are available for the Commodore 64 (P-64A) or the IBM-PC (P-IBM). Easy assembly NO TUNING". Includes FREE disk software, PC Board and Full Documentation. Kit form.

P-64A	$59.95	P-IBM	$59.95	CASE CPK	$14.95

Miniature SPEAKER-MIKE

Fits Icom, Yaesu, Alinco, Ramsey and Radio Shack rigs! Looking for a handy little speaker-mike to compliment your FX transceiver or other ICOM style handie-talkie? The Ramsey SM-1 speaker-mike is a beauty. It's only 1 1/2" wide by 2 1/2 inches high and has a handy clip on the back so you can easily clip it to your lapel or shirt. Its small internal speaker isn't going to break any eardrums but is very clear and has plenty of pop to be heard when worn. There's even a jack on the mike so when you plug it in, you still have the use of the speaker jack from your radio. Fits all Radio Shack, ICOM. Yaesu, Alinco and Ramsey rigs.

SM-7 Mini-Speaker mike,
Fully assembled....................... $24.95

CW KEYER

Send perfect CW. Microprocessor keyer features 4 programmable memories of up to 26 words each, Iambic keying, dot-dash memory, variable speed from 3-60 WPM, adjustable sidetone, keying to any rig and fully RFI proof. EAROM memory keeps messages up to 100 years - you'll go silent before the key! Includes built-in touch paddles or use your own. Easy assembly and matching case set available for a nice station look.

CW-700 Micro keyer kit	$69.95	MK Matching case set	$14.95
CW-700WT Assembled CW-700and case			$119.95

ACTIVE ANTENNA

Cramped for space? Get longwire performance with this desktop antenna. Properly designed unit has dual HF and VHF circuitry and built-in whip antenna, as well as external jack. RF gain control and 9V operation makes unit ideal for SWLs, traveling hams or scanner buffs who need hotter reception. The matching case and knob set gives the unit a hundred dollar look!

AA-7Kit	$28.95	Matching case & knobset, CAA	$14.95

AIRCRAFT RECEIVER

Hear exciting aircraft communications—pick up planes up to 100 miles away! Receives 110-136 MHz AM air band, smooth varactor tuning superhet with AGC, ceramic filter, adjustable squelch, excellent sensitivity and lots of speaker volume. Runs on 9V battery. Great for air shows or just hanging around the airport! New 30-page manual details pilot talk, too. Add case set for "pro" look.

AR-1 kit	$29.95
Matching case set, CAR	$14.95

STEREO FM TRANSMITTER

Run your own Stereo FM radio station! Transmits a stable signal in the 88-108 MHz FM broadcast band up to 1 mile. Detailed manual provides helpful info on FCC regs, antenna ideas and range to expect. Latest design features adjustable line level inputs, pre-emphasis and crystal controlled subcarrier. Connects to any CD or tape player, mike mixer or radio. Includes free tuning tool too! For a pro look add our matching case set with on-board whip antenna

FM-10A Stereo transmitter kit	$34.95
CFM Case,whip ant set	$14.95

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Descramble most scramble systems heard on your scanner radio or set up your own scambled communication system over the phone or radio. Latest 3rd generation IC is used for fantastic audio quality - equivalent to over 30 op-amps and mixers! Crystal controlled for crystal clear sound with a built-in 2 watt audio amp for direct radio hook-up. For scramble systems, each user has a unit for full duplex operation. Communicate in privacy with the SS-70. Add our case set for a fine professional finish.

SS-70 Scrambler /descramblerkit	$39.95
CSSD matching case set	$14.95
SS-70WT Assembled SS-70 and case set	$79.95

MICRO-MIKE

World's smallest FM wireless mike. Smaller than a sugur cube - including battery and mike. Two sets of SMT parts supplied in case you are clumsy! Terrific audio pick-up (pin drop at 5 ft) and transmit range of 300 ft. We include the battery (watch style), electret mike and even a tuning tool! Be a James Bond and learn SMT too!

FM-5 Micro mike kit........... $19.95

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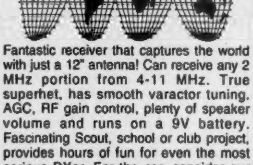
CS-1 Crystal set kit $19.95

SHORTWAVE RECEIVER



Fantastic receiver that captures the world with just a 12" antenna! Can receive any 2 MHz portion from 4-11 MHz. True superhet, has smooth varactor tuning. AGC, RF gain control, plenty of speaker volume and runs on a 9V battery. Fascinating Scout, school or club project, provides hours of fun for even the most serious DXer. For the car, consider our shortwave converter. Two switchable bands (in 3-22 MHz range), each 1 MHz wide—tunable on your car radio dial. Add some interest to your drive home!

Shortwave receiver kit, SR1	$29.95
Shortwave converter kit, SC1	$27.95
Matching case set for SR1, CSR	$14.95
Matching case set for SCI, CSC	$14.95

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Easy to build power amp has 8 times power gain, 1W in, 8W out, 2W in, 16W out, 5W is for 40W out. Same amp as featured in many ham magazine articles. Complete with all parts, less case and T-R relay.

PA-1, 40W pwr amp kit	$34.95
TR-1, RF sensed T-R relay kit	$14.95

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DN-1 Dr. Ni-Cad conditioner/fast charger kit	$49.95
CDN Matching case set	$14.95
DN-1WT Fully assembled Dr. Ni-Cad with case	$89.95

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ABOVE & BEYOND

VHF and Above Operations

C. L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake Ave.
San Diego, Calif. 92119

August is the month for many happenings, but for me it's the opening weekend for the ARRL 10 GHz contest. This is my contest—not that it's mine, but rather that I enjoy so much to be able to go out into the field and hash out all the things that I was supposed to prepare on the workbench in the months prior to the contest. If you're like me, a lot of things are put off till the last minute . . . particularly portable equipment maintenance.

I have put out so many promises in good faith of completing them, I just left my own 10-GHz equipment in the faith that it will operate as it did last year. I saw a sign in the local barber shop that put me back into perspective. "Due to numerous complaints on our free service, all further free services will be canceled." Well, the bottom line is that you can only spread yourself so thin before the bottom caves in. In my case it's not so drastic, but I have to admit I should decrease my dose of amateur-related projects. Well, enough of this psychological self-evaluation—on to this month's topic, readers' comments, and the microwave surplus evaluation, *on the fly.*

Quick Evaluations

There are several tricks of the trade to evaluate surplus material, as I say "on the fly," at swap meets and other events that we microwavers *feed* upon. This month's column will present several different ideas to assist you in making a static evaluation of these bits and pieces. I hope to cover them broadly to make best use of them. I try to practice what I preach, and therefore usually carry in the glove box of the car a suitable set of simple tools to help perform these tests should an opportunity present itself.

Photo B. Front-end view of three different power heads. Left and center: 12-18 GHz and 8-12 GHz waveguide types. Far right: 478A coaxial 10 MHz to 12 GHz.

The first item I want to cover is a reflection (no pun intended) of last month's column on power meters. I received several comments concerning what to pay for surplus power meters and, most importantly, the RF head and connecting cables. Other questions ranged from what conditions to expect and, especially, how to know if it works. We need a set of test parameters on which to evaluate a device in order to prevent purchasing another *door stop.* We want to avoid the irritation of purchasing a defective power meter. While I can't guarantee you this test will be 100% perfect, it will help to minimize any aggravation.

When you happen upon a power meter at a swap meet or flea market, it's kind of hard to evaluate the meter in its operational state unless you have AC power and a source of RF to fully test it. However, there are some basic tests that you may perform on the unit to determine if it is indeed *alive.*

For an example, I will use the HP-431-type power meter setup with thermistor cord and HP-478-type thermistor mount. This system setup can measure frequencies from 10 MHz to over 12.4 GHz with ease and accuracy using the "N" coaxial connector of the 478A power head. Other heads are available with waveguides rather than coaxial input connectors. The 478A coaxial head is the most popular, as it has the most common frequency range. However, 10- and 18-GHz waveguide heads are very good, also. The frequency of use is limited to microwave in their respective bands of operation only.

Recently I evaluated three power heads with waveguide inputs for the frequency range of 12.4 to 18 GHz and found only one suitable purchase. I also applied the same techniques to evaluate seven coaxial General Microwave power heads and found them all defective. They all carried sticker prices of $40 each—not too bad for a door stop. Just don't let your pick-up-itis get in the way of reason; evaluate what you are contemplating purchasing.

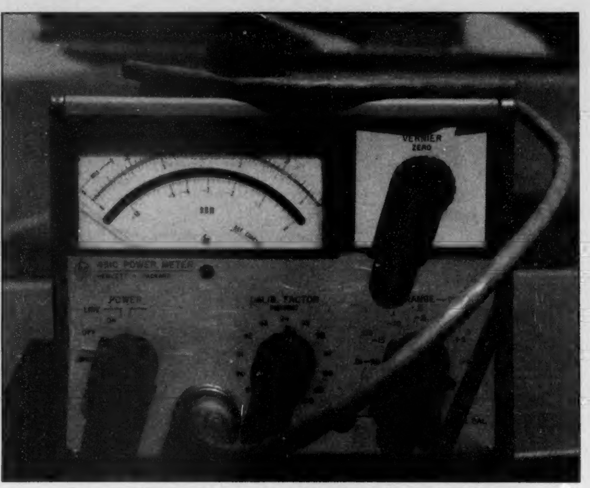


Photo A. HP-431c power meter with 478A power head and cord.

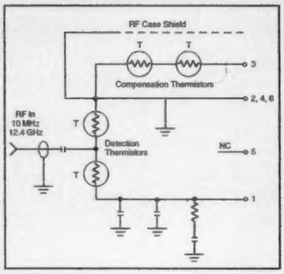


Figure 1. Hewlett Packard 478A power head diagram.

The cost of a complete power meter package with cord and thermistor mount should be less than $200 dollars. I have seen systems go for a lot less, $125 or so being more commonplace. As far as individual value goes, the basic meter HP-431 is valued at about $20 to $25, as there are a lot more meters around than cords and the scarce thermistor heads. The RF cord is valued at $20 to $40 each with the bulk of the value in the thermistor head itself. Thermistor heads can go for $80 to $100, depending on condition (appearance). Used good-but-grungy heads demand the lower figure, while new heads take top price.

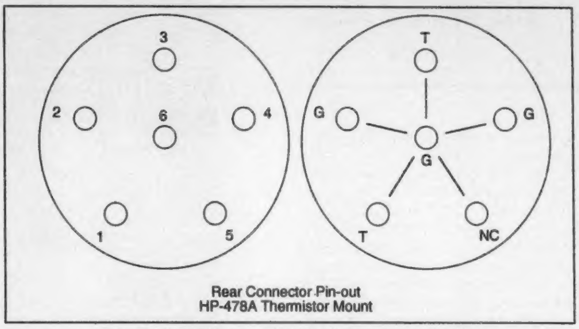
Evaluation at swap meets can be difficult, but if there is AC power, you can plug in the meter and see if you can make DC balance with the RF head attached. (Set the meter's resistance switch on the front panel to 200 ohms when using the 478A RF head.) Adjust the meter balance controls for zero indication, using both the coarse and fine balance potentialities. If a power meter will balance, it's usually in reasonable condition. While in the AC power mode, pull out your little RF test generator to make an on-scale reading. (It's a single TTL high-frequency crystal oscillator module, powered by a 9-V transistor radio battery. The unit I built is quite small and uses only eight components: a crystal oscillator module, a 9-volt battery, 5-volt zener with load resistor, three resistors in the output attenuator circuit, and the on/off switch.)

If AC power is not available, you can still test several conditions to confirm if indeed you have a bargain. What we want to determine is whether the RF thermistor head is *alive.* To accomplish this we make a DC resistance check of the thermistors in the 478A thermistor mount. For this measurement, you need an older-style POVM (Plain Old Volt Meter) or, more exactly, a nondigital-type VOM. The new digital types work, but with autoranging you don't get repeatable results. What is desirable is a range setting like x10 that does not provide high current output like the x1 scale, or the higher voltages used when in the megohm ranges. The times ten scale of an analog resistance meter (VOM) is perfect.

Photo C. Side view of the 18-GHz (left) and the 10-GHz (right) RF power meter heads.

Photo D. Rear cable end connector. Note similarity on pin-out arrangement to Motorola microphone connector.

Make a DC resistance check between the shell (ground) of the HP-478A thermistor head and the pins that would connect to the meter's cord. You will find one pin open and three pins connected to ground. The remaining two pins are direct connections to the thermistor leads. One thermistor is the actual RF thermistor that responds to RF power, and the other is isolated and is used to provide balanced temperature stability to the bridge circuit. Both



Rear Connector Pin-out
HP-478A Thermistor Mount

Figure 2. Hewlett Packard 478A ohmmeter check points.

thermistors must be matched in order to be able to balance the power meter bridge circuit.

Now what follows is not a Hewlett Packard's thermistor selection process, but rather a simple, quick, and easy-to-perform DC resistance check I use without AC power or other evaluation methods available. The resistance of each thermistor should be quite close in relationship to the other. Nominally, I have made readings near the 1,000-ohm range using a 1,000-ohm-per-volt VOM, a Radio Shack $10 special. The specific resistance is not important, just that the thermistors are in the range of 1,000 ohms. What is critical is the match between the two thermistors. I have observed some power heads thermistors read 758 ohms and 786 ohms, 1,320 ohms and 1,285 ohms, 956 ohms and 984 ohms. Others I have tested all showed readings within less than 5% or so of each other. If this match is quite close the head should work. Out of 25 or so heads verified in this manner only 2 showed problems. One was temperamental in that it showed instabilities as if it were a microphonic connection. The other one was 5 dB off in calibration and not linear. The others units evaluated out of a batch of some 75 heads (considered over many years) were not suitable for further evaluation. Most were with one thermistor open or the match was quite bad.

Examples of Bad Thermistor Heads

A bad or defective thermistor head is one with a thermistor open, usually the RF-detection thermistor. In a HP-478A mount, the maximum RF power to be detected is 10 mW, and I suspect that *10 watts* or some such excessive power caused the thermistor to go up in smoke. Usually the RF head will handle an over-range input of +20 mW for a short time, but you are "ticking the tail of a dragon" if you try.

Over-range input power also causes matched thermistors to heat up excessively and change their resistance values, ruining the previously matched set by excessive RF heating. Checking the thermistor heads in this case you might obtain DC resistance readings like 1,130 ohms and 910 ohms. The result is a head that will not zero calibrate and is considered smoked just as much as one that is open, for all practical purposes. When this happens you will not be able to balance the meter.

No matter what you do, that head is useless. The resistance must differ less than 50- to 100-ohms to be able to bring the HP-431 power meter to balance. See Figure 1 for pin out connections on the HP-478 power head.

This pin-out is the same for many manufacturers other than Hewlett Packard. I suspect most are authorized replications made under contract to HP, carrying other designators but physically identical to the HP-478A thermistor heads. Most were manufactured by Struthers. Recently I picked up an 18-GHz waveguide head that was manufactured by PRD, strikingly similar to the HP types. Even the connector seemed identical, so I tried the old POVM meter I carried in the car glove box and put it to a test. It was the only one of the three I previously described that tested good on the ohmmeter.

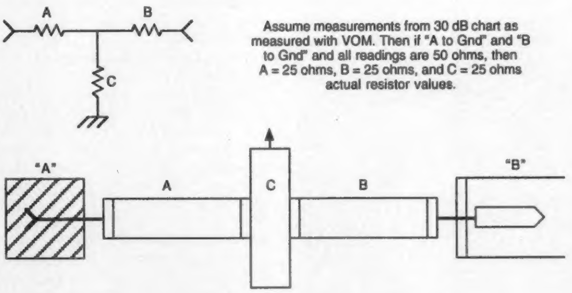
One other unit tested with both thermistors showing continuity, but their resistance readings seemed at the edge of my tolerances. I talked the surplus store into letting me take the two heads on *credit*, to be returned that day if a home test proved them incompatible with the HP meter system. Well, I am happy to report that the PRD head that tested within close tolerance did balance and reads quite accurately. The other head that seemed to be at the edge of my tolerances would not balance and was returned to the surplus store. I avoided making a costly mistake again.

Terminations and RF Attenuators

The other components needed to make good power measurements into the microwave region are a good set of variously valued attenuators. Usually a set includes 3-, 6-, 10-, 20-, and 30-dB 2-watt attenuators, more commonly called pads. Two things are important in selecting and paying a price for a pad. Pads are rated in frequency and attenuation. If you intend to use a pad at 10 GHz, make sure that it is rated to operate at this frequency. Usually the attenuation and frequency characteristics are printed on most pads. If it is not, you on your own as far as frequency is concerned. I have had some very high quality pads that looked top-of-the-line, but in performance they became screwball and nonlinear as to attenuation when the frequency increased beyond 6 GHz.

At 10 GHz a particular pad exhibited some 35-dB loss, while at 8 GHz it was 32.4 dB, and at 6 GHz it measured 30 dB. Decreasing frequency, the 30-dB loss remained stable. This showed that the pad was not designed for operation at all above 6 GHz. It did not have any frequency markings or ratings on the pad. I have tested HP pads that are rated to 12.4 GHz, and they're quite good even far above their 12.4-GHz frequency limits.

The other important rating is the loss value. Here we can make some determination if the pad is OK. Enter our handy VOM again. An attenuator or pad is usually constructed in a "T" fashion, giving equal resistance to both the input and output coaxial connectors. The usual construction form is small, cylindrical input and output resistors forming the center conductor of the "T" pad. The shunt, or center resistance to ground, is constructed with a very large diameter resistor connected at its center to the input/output resistors. Circular in design, its outer edges are connected to ground and it acts as a shield between the input and output of the pad. See Figure 3 for construction details.



Assume measurements from 30 dB chart as measured with VOM. Then if "A to Gnd" and "B to Gnd" and all readings are 50 ohms, then A = 25 ohms, B = 25 ohms, and C = 25 ohms actual resistor values.

Resistors "A" and "B" are small tubular resistors with diameters approximating a 50-ohm coaxial transmission line. Resistor "C" is much like a "Lifesaver" shape, grounded on the outside ring and acts as a resistance to the center conductor.

Loss	A to Gnd	B to Gnd	A to B
5 dB	100	100	29
10 dB	64	64	50
15 dB	56	56	74
20 dB	51	51	95
30 dB	50	50	50

Figure 3. Microwave "T" pad construction.

Mailbox Comments

From Donn Baker WA2VOI, concerning WA6CGR's power supply circuit in the January column: "I've been using a modified version of the circuit for more than a year now to provide +24 volts for a TWT on 2,304 MHz when roving. I didn't need the multiple voltage, so don't have to utilize the +20 and -5 volts circuits. I take +25 volts or so at 3 amps continuous from the circuit. The Micrometals T-106-26 (Amidon T106-26) core that CGR uses is far from optimum as the basis for the magnetics. The -26 material is powdered iron, and as such is suitable for a DC choke, or 60-Hz line filter. Its losses are somewhat excessive for use at the 40-kHz switching frequency of the LT-1070. As both WA6CGR and myself are running the LT-1070 at pretty close to its maximum, the losses in the core can be significant. (WA6CGR is drawing about 90 watts, I'm drawing about 75.)

"I originally built my first supply with the T-106-26 and it ran hot. The overall efficiency was about 70%. After I burnt my fingers a couple of times, I replaced the T-106-26 core with an Amidon EA77-500 'E-core.' That core runs cool, and the overall efficiency was measured at 84 % . . . a more than significant improvement. I'm using 30 turns of #18 AWG tapped at 11 turns. This appears to be the same as WA6CGR used on the -26 core. Incidentally, Linear Technologies application note AN-19 talks all about the LT-107X family, and is worthwhile having if you're going to do anything serious with these regulators." Donn Baker, 3128 Silver Lake Road, Minneapolis MN 55418.

Thanks, Donn, for the fine comments and workbench-related tips on working with the LT-1070 switching regulator. Comments like this are very constructive and I like to include them in this column for sharing with our readers. By the way, I started getting into electronics in the Minneapolis area at Washburn Jr. High School through the intervention of a science teacher there. I lived near 64th Street on the edge of what was then (in the '50s) Minneapolis and the suburbs of Bloomington and Richfield. Lots of fond memories.

Well, that's it for this month. As always (10 GHz contest time permitting), I will be glad to answer questions regarding this and other related topics. Please send a SASE for prompt reply. 73 Chuck WB6IGP

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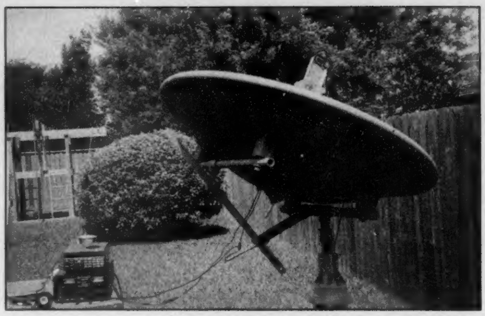

Photo A. Early Mode "S" experiments at WA5ZIB used a 4-ft dish.

New Satellite Modes

Excitement and enthusiasm were high when AMSAT-OSCAR-7 was launched in 1974. The new amateur-radio satellite carried two analog transponders in addition to an advanced telemetry system. The Mode "A" transponder used a 2 meter uplink with a 10 meter downlink. AMSAT-OSCAR-6 had pioneered this mode a few years earlier and had become extremely popular with operators around the world. There were some complaints, though, from the amateur community about the new Mode "B". It required users to uplink on 70 cm and receive on 2 meters. SSB and CW equipment for Mode "B" was in short supply 21 years ago. In time, the advantages of a UHF uplink coupled with a VHF downlink became apparent, and commercial gear more available. Lower noise and more RF spectrum made "B" the favorite.

Mode "S"

When AMSAT-OSCAR-13 was launched, the same complaints surfaced again. This time the focus was on Mode "S". The 70 cm uplink was not a problem, but the 13 cm downlink was considered far beyond the reach of the typical satellite fan. A-O-13 also carried a Mode "B" system like that on A-O-7, a Mode "J" transponder like AMSAT-OSCAR-8 (2 meters up and 70 cm down), and a Mode "L" transponder like AMSAT-OSCAR-10 (23 cm up and 70 cm down). Thanks to the inclusion of Modes "B", "J", and "L", grumbling about the 13 cm downlink of Mode "S" was mild. Most satellite operators simply ignored it.

When the 70 cm transmitter on A-O-13 failed a few years ago, interest in Mode "S" grew. Modes "J" and "L" were no longer operational and additional time was set aside for Mode "S" in the A-O-13 operating schedule. Devoted experimenters were delighted with the expanded opportunity to try their hand at receive-converter design and microwave antenna work, and others began to take notice of this neglected mode.

The A-O-13 Mode "S" transponder was developed as a proof-of-concept project, not as a primary system. The average power output is 1.25 watts to a 9-dBic (decibel, isotropic, circular) helix antenna. This means that when the antenna is pointed at the earth, the satellite provides 10 watts EIRP (Effective Isotropic Radiated Power) with right-hand circular polarization. The 9-dB antenna gain represents a multiplication factor of eight. This output can be used for the beacon signal or the transponder system; both are not active at the same time. The beacon transmits on 2,400.661 MHz and the transponder downlink ranges from 2,400.715 to 2,400.749 MHz. The corresponding uplink goes from 435.602 to 435.636 MHz. The transponder is non-inverting. This means that a USB signal low in the input range will be retransmitted as a USB signal low in the output range.

The Gear

Some amateurs had been active with MDS (Multipoint Distribution System) TV reception around 2155 MHz for a number of years when A-O-13 was launched, and UHF SSB and CW work was no longer uncommon. The jump to narrow-band, weak-signal satellite communications on 2.4 GHz required a union of techniques from both arenas. Better front-end circuitry and stable local oscillator circuits were required in addition to microwave construction techniques. Designing and building such items required esoteric test gear and significant RF design work.

Early receive-converter kits for Mode "S" removed the microwave design requirements, but tune-up and troubleshooting left many would-be "S"-mode enthusiasts with unfinished converter projects gathering dust. Most hams do not have access to spectrum analyzers and test equipment that even approach the frequency range of Mode "S".

Newer "no-tune" converter kits helped considerably. The use of stripline filters directly etched on the circuit boards and the introduction of MMIC's (Monolithic Microwave Integrated Circuits) made the difference. If the circuits in the finished kit drew the right amount of current, they were probably working. Armed with a coffee-can feedhorn and a small dish reflector, the new Mode "S" chaser had a good chance of getting something off the bench and on the air. Packaging the collection of circuits and preparing the antenna for permanent outside operation tended to slow down the process and, for some hams, provided another round of dust-gathering, expensive, closet gear.

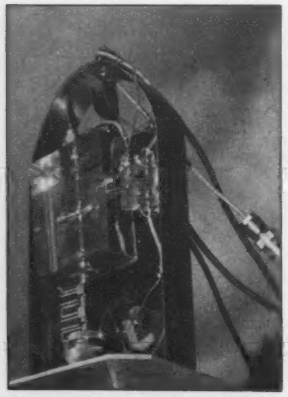

Photo B. The preamp/converter side of a Mode "S" unit using parts from Down East Microwave.

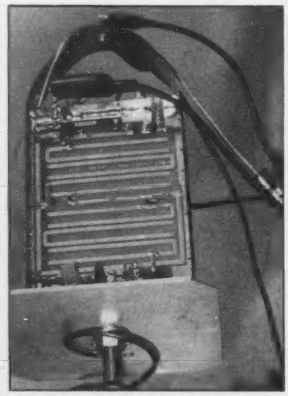

Photo C. The local oscillator side of the Down East Microwave Mode "S" receive converter with a small helix for the dish feed.

COTS

Thanks to the proliferation of microwave circuits for consumer applications like satellite television, the components for simple, high-performance, COTS (Commercial, Off-The-Shelf) S-band ham equipment have become readily available. While kits are still available from places like Down East Microwave, complete ready-to-go receive converters and antennas can now be easily purchased.

The major amateur radio manufacturers have yet to make Mode "S" equipment for the U.S., but other, more specialized firms have created products specifically designed for Mode "S" satellite reception. Four companies that sell 2.4-GHz converters, preamps, and accessories include Down East Microwave, SSB Electronics, Bob Myers Communications, and TGN Nachrichtentechnik GmbH. All of the units convert 2,400–2,404 MHz down to 144–148 MHz.

Down East Microwave sells an assembled version of their converter kit for $255. The front-end noise figure is relatively high, around 5 dB, but coupled with a low-noise preamp, the unit performs well. A waterproof enclosure is necessary if the unit is to be mounted at the antenna. The matching preamplifier sells for $130. The address is 954 CR 519, Frenchtown, NJ 08825, and the phone number is (908) 996-3584.

You can contact the U.S. outlet for SSB Electronics (a German company) at 124 Cherrywood Drive, Mountaintop, PA 18707. Jerry Rodski K3MKZ runs the operation and can be reached at (717) 868-5643 during evenings and weekends. The FAX line is (717) 868-6917. SSB Electronics has been making VHF, UHF, and SHF gear for many years and has three types of converters for Mode "S". The least expensive is the UEK-2000S, which has an SMA input connector and is not weatherproof, but sports a 0.8-dB noise figure. The price is $389.95. The UEK-2000SAT is a mast-mounted, weatherproof version with N-connector input, a noise figure of less than 1.0 dB, conversion gain of 20 dB, and a price tag of $429.95. The top-of-the-line unit, the UEK-2000SAT/01, is similar, except with a 30-dB conversion gain, and sells for $459.95. A preamp is not necessary with these units when mounted near the receive antenna. The SSB Electronics catalog contains a complete line of preamps, power amps, converters, and low-loss coaxial cable. They also stock all of the M-Squared antennas.

A new entry in the downconverter market is Bob Myers Communications. Bob W1XT publishes *OSCAR Satellite Report* and *Satellite Operator* in addition to selling many hamsat-oriented products. Bob's SBDX-2400 remote downconverter comes complete with a wall-mount power supply and DC isolator, allowing the unit to be powered through the coaxial line between the unit and the 2 meter receiver. The advertised conversion gain of the unit is a minimum of 40 dB and includes two stages of 2.4-GHz preamplification. The price is $389.95 plus $12.00 for U.S. shipping and insurance. The address is P.O. Box 17108, Fountain Hills, AZ 85269-7108, and the phone is (602) 837-6492. The FAX line is (602) 837-6872. Bob can also be reached via E-mail at bmyers@primenet.com.

A foreign company of note that produces an array of microwave subsystems, preamplifiers, converters, and components for OSCAR and other satellite pursuits is TGN Nachrichtentechnik GmbH of Germany. They have four versions of Mode "S" receive converters. Each is weatherproof, has a conversion gain of at least 30 dB, and is powered via the coaxial feedline. Every unit is provided with tested noise-figure specifications performed on a Hewlett Packard HP8970B Noise Figure Meter. The prices are based on front-end noise figure measurements. The LNB2400/0.7 (0.7-dB noise figure) sells for 360 German marks. The 0.6-dB version sells for 400 marks and the 0.5-dB model is priced at 445 marks. A 0.4-dB version is available, but for substantially more money, and it has an SMA input connector. The others have N-connectors. A DC isolator (Fernspeiseweiche) is sold separately for 58 marks. The address is Ariusstr. 23, D-66957 Ruppertsweiler, Germany. The phone number is 49-6395-8021 and the FAX line is 49-6395-8082. Although the prices look good even at current conversion rates, there is the matter of shipping, which can easily add another 100 marks. Credit cards (Visa and American Express) are accepted.

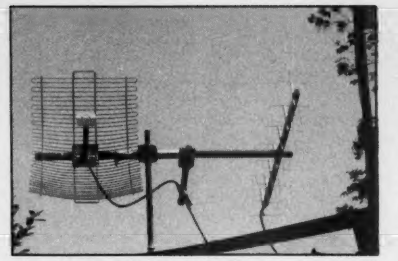

Photo D. Portable Mode "S" array using commercial antennas for the 70 cm uplink and 13 cm downlink.

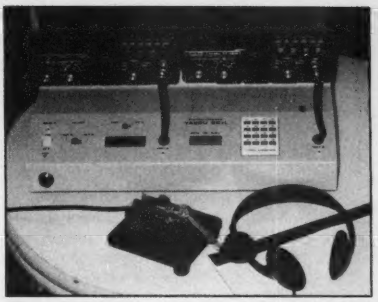

Photo E. Small Yaesu all-mode VHF and UHF rigs for the portable Mode "S" station.

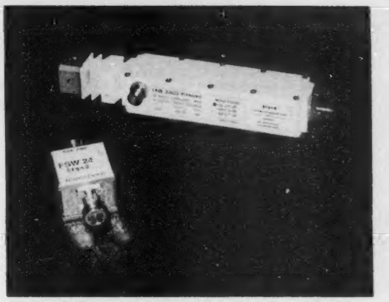

Photo F. An antenna-mounted downconverter for Mode "S" converts the 13 cm signals to the 2 meter band. This unit is from TGN Nachrichtentechnik GmbH in Germany.

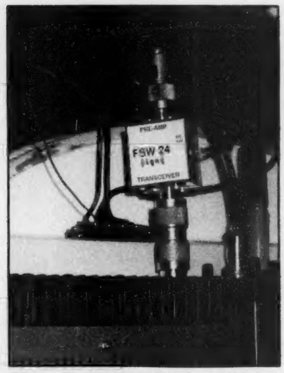

Photo G. A power-block module allows 12 VDC to be sent to the downconverter via the coax.

Antennas

By far the best Mode "S" antenna buy for the money is the SB-32DXC from Bob Myers Communications. This custom-tuned version of an MDS-TV antenna installs easily and provides plenty of gain for reception of A-O-13 Mode "S" signals. It is a horizontally polarized, three-foot by two-foot, parabolically shaped reflector with feed assembly and RG-8 coax pigtail terminated with a male N-connector. The new version fits 1.5" to 2" booms and sells for $55.95 plus $12 UPS ground shipping in the U.S. Bob Myers Communications also carries some M-Squared antennas and can be contacted at the address noted above.

Other antennas worthy of consideration include loop yagis from Directive Systems (Dave Olean K1WHS) at RR1, Box 282, Lebanon, ME 04027, phone (207) 658-7758, and standard yagis from M-Squared via SSB Electronics in Pennsylvania, or direct at M-Squared, 7560 N. Del Mar Ave., Fresno, CA 93711, phone (209) 432-8873 or FAX (209) 432-3059.

Before Buying!

It is not possible to cover all the details of Mode "S" operation in a single article. Before joining the microwave satellite crowd, get the catalogs and flyers from the available manufacturers and providers, and study the subject in depth.

Early this year, AMSAT, the Radio Amateur Satellite Corporation, published *Mode S—The Book* by Ed Krome KA9LNV. Ed covers the history of 2.4-GHz satellite operation and provides all of the pertinent articles and information available on the topic in a concise, 8.5" by 11", 115-page paperback volume. In addition to discussion of practical construction techniques, the reader will find useful information on how to get started with 13 cm signals from A-O-13, PACSAT-OSCAR-16, DOVE-OSCAR-17 and the future Phase 3D "S"-mode transponder. Ed is a mechanical engineer, not a microwave physicist. His practical and direct approach to the topic is appropriate for those looking for "hands-on" input. This is must reading for the long-time satellite chaser and newcomer alike. The cost is $15.00 from AMSAT, 850 Sligo Ave. #600, Silver Spring, MD 20910. AMSAT's phone number is (301) 589-6062. Mode "S" promises to be the mode of choice for the next decade. Give it a try. You'll like it up there. ■

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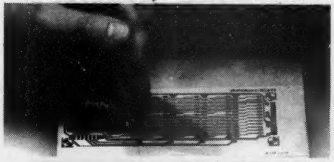
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The Small Wonder Labs 40-30 Kit

The original NN1G rig by Dave Benson generated a lot of interest among QRPers. It's hard to follow up with a project that performs better than the original, but Dave has another hit on his hands. This rig originally started out as a club project for the New England QRP club, and was so popular among the members, that a second kit run had to be produced.

Dave's taken up where the original kit ended and made some slight modifications to the circuit. But, before we get to those, let's take a look inside the Small Wonder Labs 40-30 rig!

Having built more than enough QRP transceivers on 40 meters, I decided on a change to the 30 meter band. This band is full of active QRPers yet provides good DX possibilities. Best of all, you don't need to put up with the constant QRM from the broadcast stations, and there's no SSB to contend with, either. By gentlemen's agreement, digital modes such as AMTOR, packet, and RTTY are on the high end of the band, while CW occupies the lower end.

The 40-30 is simple in its design. With a 13.5-volt power supply, the rig will produce about 1.5 watts into a 50-ohm load. My unit did a hair more than 1.3 watts at 13.8 volts. Power produced at 12.5 volts was a solid one watt. That's more than enough kick to work all over the world on 30 meters. The 40-30 supports full break-in electronic keying with sidetone. Yet this rig does have a few drawbacks. First, there's no AGC. You control the audio gain by adjusting the RF gain control. The 40-30 won't drive a speaker. It's a headphone-only rig. There's no RIT, although you can add RIT by using an additional circuit board. I'll talk more about the RIT in next month's column. For now, we'll deal with the 40-30 in its basic form.

Signal Flow

RF from the antenna is controlled by a brute-force RF gain control. From here, the signals are passed through a single tuned circuit. An NE602 is used as a mixer by combining the VFO energy and the desired signals. The output is sent through a very simple two-pole crystal filter. Why only use two crystals? With a circuit such as this, most of us will never be able to tell the difference between two and four poles of filtering. It also reduces loss of signal through the filter, and it's cheaper, too. Even with a two-pole crystal filter, the selectivity is quite remarkable. The center frequency of the filter is about 850 Hz.

If you look at the schematic, you'll see something missing. The 40-30 lacks both IF tuned circuits and an IF amplifier stage. The output of the crystal filter is dumped directly into the product detector. You can move the product detector's frequency a bit to provide the proper offset in the receiver.

From the product detector, the output is coupled to a simple MOSFET switch and then on to the audio amplifier. As I mentioned before, the audio stage will not produce enough output to drive a speaker. The stage is robust enough that strong signals will automatically cause your fingers to move toward that gain control. As Dave mentioned in the assembly instructions, if you use a cheap pair of headphones, you'll get lackluster results. Those walk-thing headphones you see hanging up at the checkout counter for $2 will give you two bucks worth of sound quality.

VFO Circuitry

In the 40-30, instead of the usual variable capacitor controlling the VFO, a varactor is used. Tuning the VFO is accomplished by varying a 100k front-mounted pot. The tuning range is set by a small trimmer capacitor and by compressing or expanding the turns on a toroid core. This is the same method used by the NorCal 40 and has proved very popular with operators. By using the varactor diode, the builder has one less worry when assembling the kit. Mounting a variable capacitor to a panel can be a real engineering feat.

Building the 40-30

You should have gone through several soldering iron tips before tackling the 40-30. Although the circuit is very basic, there's not much room on the PC board. The circuit board is single-sided with a top silk-screen. All pads and traces have be solder-reflowed, and there is even a solder mask on the bottom.

All the parts are first rate, with several of the smaller diodes marked individually for easy identification. All the capacitors fit the board without tugging and pulling at their leads. Sockets are included for all ICs, even the NE602s.

Depending on the band chosen, the frequency-selective parts are packaged separately. Follow the directions closely, as you must not mix the contents of these envelopes with the rest of the parts.

You must wind your own coils. The instructions for doing this are as clear as humanly possible. In fact, I'm impressed with the idea of using a hunk of paired hookup wire for winding the secondary on one of the phased transformers. It's about as fool-proof as you can make it. Even Scott should be able to figure this one out. It should be no big deal to wind the coils for this rig.

Setup and Adjustment

There are only a few steps required to get the rig on the air. First, you'll need a signal source. I used my Argonaut II running milliwatts into a dummy load. You'll also need a wattmeter for peaking the transmitter. Although not in the list of needed equipment, a frequency counter is really nice to have. If you don't have one and can't borrow one, then you can use a general coverage receiver to find the operating frequency of the VFO.

Alignment is straightforward. First, you need to find the frequency of the VFO with a frequency counter or your general coverage receiver. You then tweak the turns on the VFO toroid to adjust the frequency. A trimmer capacitor sets the band edges, while adjusting the coil gives you bandwidth.

Once the VFO is running at the desired frequency, connect your antenna, and, providing the band is up, resonate the front end by tweaking a second trimmer capacitor. At this point, you should be able to hear stations. Peak the stage for maximum audio by listening to a weak station. This completes the tune-up for the receiver.

Transmitter tune-up is just about as easy. Into a dummy load, key the rig and adjust the two trimmers for an indication of output using an RF power meter. I adjusted the transmitter by using my scope and peaking for maximum power while maintaining a clean sine wave. You can also press your station receiver into use by using it as a monitor peaking the transmitter for maximum S-meter. Back off the trimmer that sets the output power until the level drops, then turn the trimmer up until no more power is observed. Don't advance the power control past this point. The final adjustment to the transmitter is setting the TX offset. Again, you can use your general coverage receiver or make a quick job out of it with a counter.

Odds and Ends

I wound the VFO tank coil with the required amount of wire, but the final frequency was way too low. I removed a turn or two too many and ended up too high in the band. I added an extra 68-pF capacitor across the trimmer cap and then compressed the windings as much as I could to bring the VFO to the proper frequency. I'm sure you'll have to experiment with the VFO coil to get the proper frequency range.

The assembly manual mentions the polystyrene capacitors used in the VFO as being rather fragile. They are. After they have been soldered in, a glob of coil dope or some other goop is necessary to prevent them from moving about. I mention this not only to improve your frequency stability, but to keep you from breaking the leads off.

The final output transistor in the transmitter does not come with a heat sink of any kind. Dave assures me none is needed. During tune up, the stinker can get rather hot. I placed a TO-5 slip-on heat sink on the device just to make me feel better. You should do the same.

Dave put a lot of work into the assembly manual. It's not a step-by-step building guide, but it covers all the bases. If you have put several kits together, and know one end of a diode from another, you should have no trouble with this "small wonder."

Next month, we'll take a look at the RIT circuit and some other modifications to this rig.

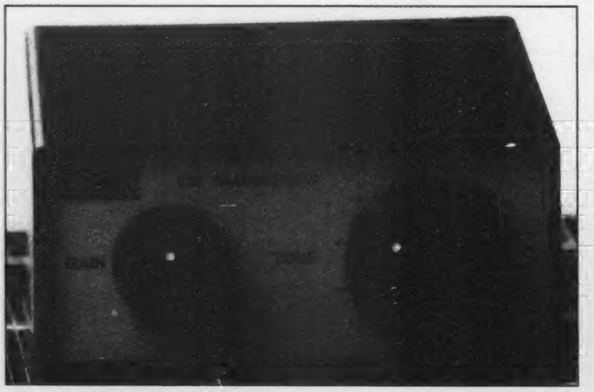

Photo A.The Small Wonder 30 meter rig sitting atop a small 10-watt solar panel.

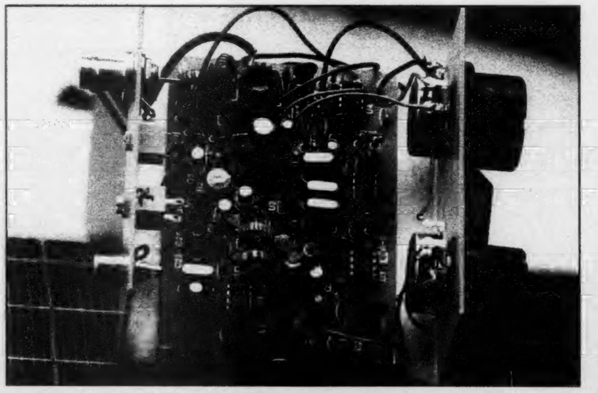

Photo B. Inside the rig. Everything mounts on a single board.

Number 24 on your Feedback card

PACKET & COMPUTERS

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Introduction to Packet Radio

While this subject may seem a bit simple to my regular readers, it seems like a good time to write an introductory column again. You may be surprised and learn something you didn't know. In any case, it will be a great column to pass on to these friends who want to get started in packet radio.

Just What Is Packet Radio Anyway?

Packet radio is one of the many "digital" modes available to radio amateurs. It is used on bands from HF to SHF, and is unquestionably the most popular way to send text and graphical information using amateur radio. With all of the other digital modes to choose from, what makes packet so popular?

Packet gets its name from the way that data is transmitted, in data "packets." By using this idea (called "packet switching"), packet radio's "protocol" (set of rules), called AX.25, can offer some big advantages over the other modes. The one that launched packet's popularity is "error detection and correction." Packet radio's AX.25 protocol offers error-free transmission. When a packet of data (technically referred to as a "frame") is sent from one station to another, it includes a "checksum." This checksum (it is a CRC—Cyclic Redundancy Check—for you math weenies out there) is the result of a mathematical operation performed on all the data in the packet.

When the packet is received at the intended destination, the receiving station performs the same mathematical operation. If the results do not match, it indicates that an error has occurred in transmission and the sending station is notified to resend that particular packet by its sequence number.

This system of error detection (checksum) and correction (resending) offers error free transmission—eventually. Sometimes it can take many tries before getting a "clean" packet. There are some things that can help with this, and we'll talk about them a little later.

What Do I Need to Get on the Air?

Thanks to the folks at TAPR (Tucson Amateur Packet Radio), who designed the original and updated hardware (TNC, or Terminal Node Controller) that made packet radio the popular mode it is today, getting on the air is simple. Exactly what to buy depends on two things: what you already own, and how much money you have to spend.

You'll need three basic components in any case: terminal, TNC, and radio system. The TNC is the heart of the packet station. It is the interface between the terminal (we'll discuss that in a moment) and the radio. Inside the box are two parts—the PAD (Packet Assembler/Disassembler) and the modem.

In packet radio work, we *don't* actually transmit digital signals over the air. Instead, we convert the digital information to sound and send that. This is the job of the modem, which gets its name from MOdulate/DEModulate. It is another version of what you use on the phone line to connect to BBSs and the Internet.

> ***"So if you want to get started in packet, look around at what you have (radios and computers), look around at what to buy (TNCs or multimode controllers), and make a careful selection."***

The task of the PAD is to take the information that we want to send and "assemble" it into packets. It maintains the connection with remote station (called a "virtual channel") and sends the data in packets that are understood on the other end. The reverse process happens there: The signals are demodulated in the modem and "disassembled" by the PAD.

This virtual circuit idea is pretty important, and it is where the idea of packet switching comes in. One of the other advantages of packet over other modes is that a channel can be shared. When two packet stations connect, a virtual channel is formed. The "owner" of the real channel (the frequency of operation) "switches" with each packet sent. There we get "packet switching." Other than having to wait around for its turn, your station thinks it is on its own channel.

The TNC you buy will depend on what you intend to do. Most packet today—almost all—runs at 1,200 baud. This used to be pretty fast, back when telephone modems were mostly 300 baud. Today we think nothing of 28.8 Kb/s phone modems, and some of us have access to faster connections. Nevertheless, packet radio does the overwhelming bulk of its end-user business at 1,200 baud.

If your intention is simply to get involved in PBBS (Packet BBS) use, and keyboard to keyboard operations (QSOs between individual stations), 1,200 baud will be all you need. Today, prices for TNCs range from around $100.00 for a simple unit that does the basics, to several hundred for a DSP (Digital Signal Processing) unit that is really more than a simple TNC and is referred to as a multimode controller.

In the first category, products from AEA, MFJ, Kantronics, and PacComm all offer good performance for the average user. One of the more popular "beginner" units is the KPC-4 from Kantronics; its small size and low power requirements make it a good portable option as well.

For a multimode box the selections are more complex. If you'd like to get into the HF modes (RTTY, AMTOR, PACTOR, and other relatively esoteric things), you'll need to choose carefully. For the average HF/VHF packet user, the PK-232 from AEA is a reliable winner. Its excellent filtering makes HF work easier, and its design is well proven. The DSP-2232 from AEA represents the high end, with DSP-based, dual-port operations. Your wallet will notice the increased capabilities.

Another real option, of course, is the hamfest. If you look around for TNCs at a hamfest, make sure you get a TNC-2 model; this is very important because a TNC-1 may be able to have its firmware updated, but it will be a hassle. Look for products from the companies mentioned above, and you can probably walk away with a good unit for fifty bucks or less.

The Terminal

Technically, all you need for this function is a "dumb terminal." One of the old-fashioned "glass teletypes" would work fine; *but*, today there is so much software available doing such nice things that you really *want* a computer. The overwhelming majority of hams use IBM-PC machines. Just how capable the machine needs to be depends upon how you use it. Most of the DOS-based packet software runs well on a 1-MB 80286 machine. You don't even need a hard drive in most cases. On the other hand, if you'd like to run the latest and greatest of packet software, you'll need a machine that can run Microsoft Windows. The best bet is to talk to *lots* of ham friends, see what they are using, *use it yourself*, and then decide.

The Radio System

I refer to radio "system" because I include the antenna. There is a great temptation to take that old handheld, blow off the dust, and stick it on packet. This is likely to be a problem. It is not that it won't work, since it will transmit and receive fine. The problem is that you may not be able to communicate with anyone.

OK, now you are confused. If the radio works fine, I can hear the station I am trying to talk to, and it can hear me—why can't we communicate? Anyone who has experienced this phenomenon knows just how frustrating it is, and wants it to stop! The problem is called "hidden transmitter syndrome" and here's how it happens ...

At the lowest level, packet radio networking is based on the idea of CSMA/CD (Carrier Sense Multiple Access/Collision Detection). This is the name of the method of sharing the channel. The mechanics will be very familiar to any active ham—you use this technique every day. "Carrier Sense" means to listen to the channel and see if anyone else is keyed up. If there is someone on, say, the repeater, you are careful not to key up over them. "Multiple Access" simply refers to the fact that more than two stations can use the same frequency. This is opposed to point-to-point linking, in which two stations exclusively use a particular frequency. "Collision Detection" means that the protocol can say,"hey, you guys doubled," when two transmitters happen to key up at the same time.

It is the CS portion of this access method in which handhelds (with weak transmitters and often poor receivers) cannot properly participate. A hidden transmitter is a station that cannot be heard by *everyone* trying to use the frequency. This means that those who cannot hear will try using the channel *on top of the hidden transmitter*. A poor receiver causes everyone to be a hidden transmitter.

Because of this, beware of handhelds. Use a good *omnidirectional* antenna, and put an amplifier with a preamp on that handheld if you must use it. If everyone on the frequency participates properly in the LAN (Local Area Network), everyone benefits. *Remember, this is true even for keyboard-to-keyboard QSOs!*

So if you want to get started in packet, look around at what you have (radios and computers), look around at what to buy (TNCs or multimode controllers), and make a careful selection. Don't try to use something inadequate, because you'll just get frustrated and quit. Do it right, and have fun. 73 de N1EWO.

HOMING IN

Number 25 on your Feedback card

Joe Moell P.E. KØOV
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Fullerton, CA 92633

APRS Puts Doppler Bearings on the Map

"It's like a moving finger that keeps pointing toward the signal." That's the way one ham describes his Doppler radio direction finding (RDF) set. Typical of most Dopplers, his has a circle of 16 light-emitting diodes (LEDs). At any instant, one LED is on, indicating the direction of the incoming signal.

Dopplers work with all types of narrowband FM receivers, including scanners and handhelds. Some include a digital display in degrees, in addition to the LED ring. Doppler antennas, which have from 4 to 16 vertical elements, are available for home use and for easy mounting on a vehicle. (See the resource box.)

You might think that hunting signals with a Doppler RDF set is as easy as fishing in an aquarium. Just follow the LEDs, right? Occasionally it's that simple, but more often the Doppler display is tricky to interpret. Incoming signals are reflected and scattered by buildings and terrain features near you and near the transmitter. This multipath, as it is called, makes the Doppler think there are several signal sources instead of just one. So, depending on the multipath where you're RDFing, sometimes you will see one steadily lit LED, and at other times the indication may flutter, wander back and forth, or even dash around the circle.

Then there is the matter of knowing exactly which way and how far to go to find signal sources. The Doppler's direction indication is relative to orientation of the antenna set. In a fixed installation, this is the same as a bearing with respect to north. In a mobile, you must know your car's heading accurately to be able to compute the compass direction of the signal from the Doppler indication.

A Doppler gives you only direction data, not distance. As you drive toward the transmitter, your S-meter will probably be pinned by the time you are within a few miles. Unless you go to the trouble of using an RF attenuator, you will have few clues about how close you are getting until there is a sudden change of bearing that tells you that you passed it!

Wouldn't it be great if your Doppler indications could be displayed directly on a road map? While we're at it, why not have bearings from other base and mobile stations appear on the same map, so you can see instantly where they intersect? Automatic Packet Reporting System (APRS), a shareware computer program, makes all this possible right now.

Retire Your Protractor

When Bob Bruninga WB4APR first developed APRS, it was just for mapping packet stations, both fixed and moving, for fun and public service. He envisioned it as a way for officials at events such as marathons and boat regattas to instantly spot the locations of contestants, VIPs, ambulances, and so on. Then he began to add features such as dead reckoning of moving objects, messaging between unconnected stations, and grid-square plotting.

With the latest version, storm tracking nets can pinpoint their weather spotting units, HF contesters can display Packet Cluster DX reports, and transmitter hunters can create multistation RDF networks to quickly zero in on jammers, stuck transmitters, and stations in distress. WB4APR's program runs under DOS (not Windows) and can be used in just about any PC, from a 8086 laptop with CGA in a mobile to a high-end hamshack desktop in full color.

Macintosh fans have not been left out. Keith Sproul WU2Z has coded up a work-alike program. It runs best on Mac-II class machines with System 7, but will also work on older 68000 Macs. MacAPRS follows all the PC-APRS packet protocols but takes full advantage of the Mac's capabilities for higher resolution maps, pull-down menus, multiple windows, and the mouse. A MacAPRS native version for PowerPCs is also available.

Since APRS PC version 3.0 was released last year, the program has included a steadily improving suite of RDF features. The most advanced of these are the Doppler inputs, which became fully operational in version 5.03a. Bob added routines to accept and display bearings from Doppler Systems RDF models having 300-bps RS-232 output. For Doppler Systems models without serial data output, and for other brands of Dopplers, WB4APR collaborated with Robert Swain N7LUE to develop a universal interface.

The project was so successful that N7LUE is now selling boards, kits, and complete interfaces (Photo A). "I'm trying to make it as close to a Heathkit as practical," Robert says. "This is my first experience in writing kit-building instructions, but I've had lots of experience in the military telling people how to put things together."

Inside the Interface

In all of the popular Doppler designs in the ham market, the 360-degree azimuth circle is represented by 8, 16, or 32 LEDs. Somewhere in the control/display electronics, 4-bit parallel data representing antenna position and a direction pulse to latch this data for the display are available. Figure 1 shows how N7LUE's interface converts this parallel data to a serial output. All signals are tapped from the Doppler circuits; normal operation of its LED display is unaffected.

U1 is a 74HC75 4-bit latch. It is disabled when the circuit is used with Doppler Systems, Dick Smith, and other designs that have latched 4-bit direction data available. Other Dopplers such as the 16-LED KØOV/WB6UZZ Roanoke Doppler and the WA4BVY DoppleScAnt use a 4514 or 4515 latching 4-to-16 decoder IC, which does not put latched 4-bit direction data onto external pins. Data is latched by U1 for these models.

Latched data from U1 goes to U2, a Microchip AY31015D universal synchronous receiver/transmitter (UART) that performs the parallel-to-serial conversion. The output of U2 is a stream of 8-bit ASCII characters from

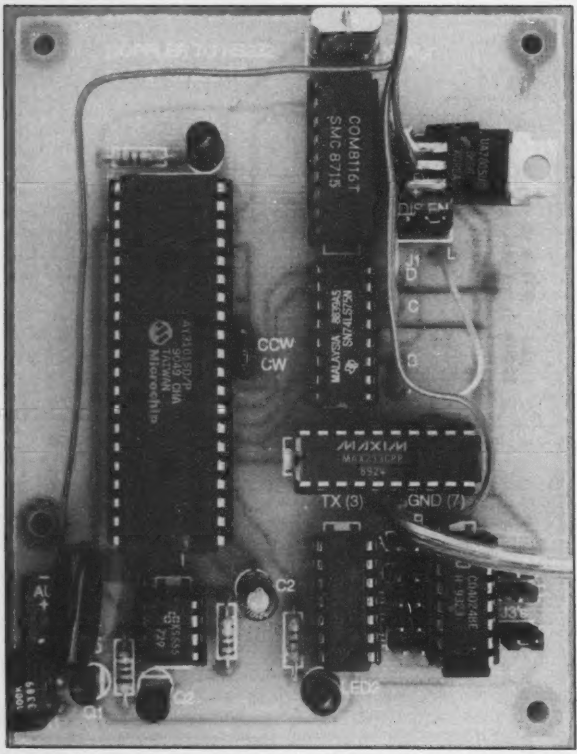


Photo A. N7LUE's Version 1 interface board measures 3-1/8 x 4-1/8 inches. I added a 7805 regulator at the +5V input terminals on mine. A 9-wire ribbon cable connects to my Roanoke Doppler via DB-15 connectors to pick off power, audio, and parallel data.

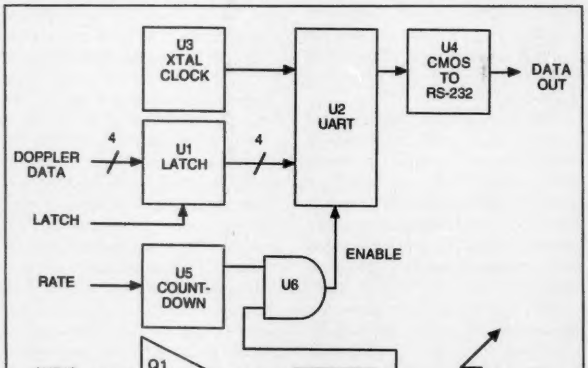


Figure 1. Block diagram of N7LUE's universal Doppler-to-RS-232 interface for RDF with APRS.

"@" (01000000) to "O" (01001111), representing the 16 possible states of the 4-bit input data. U2 is programmed for 2,400-bps 8-N-1 output, as expected by APRS.

Note that no matter how many LEDs or vertical antennas your Doppler has, N7LUE's board always outputs 16 output characters, representing 22.5-degree azimuth increments. U4 converts the serial data from 5-volt logic level to RS-232 standards.

APRS software can process about eight bearing samples per second. U5 is a 4024 binary countdown, driven by the Doppler's antenna rotation clock oscillator. Its 8-Hz output sets the UART character output rate. Q1, Q2, and U7 sense receiver audio, preventing random data output when no signal is being received.

U8 was added to the design for situations where APRS is transmitting packet bearings in the same band that the Doppler is monitoring. When the packet TNC is keyed down, the Doppler bearing will probably be erroneous. The U8 data mute interrupts serial output during packet transmissions, to prevent these bad bearings from being processed by APRS.

Crunching the Bearings

WB4APR's software accumulates and calculates the average and standard deviation of a series of bearing samples to the nearest degree. It plots the average as a yellow vector on the screen map. The standard deviation calculation gives a measure of the quality of the bearing data. When samples differ greatly in direction over a short time, deviation is large and the displayed line is dotted to indicate a low quality bearing. The more breaks in the line, the larger the deviation is. When Doppler indications are steady, deviation is low and the yellow line is solid. A violet rectangle at the top of the APRS map display provides additional bearing quality data.

Photo B shows typical APRS Doppler data displayed on a base station PC screen. The dashed yellow bearing lines from the K0OV icon were picked up during a 30-second transmission from a mobile station. The cross-bearing from WB6UZZ/M could have been received and plotted by packet or entered manually by the APRS operator from a radio report.

The APRS cursor has been moved manually to the intersection of the K0OV and WB6UZZ bearings. The exact latitude and longitude of this intersection is displayed in a box at the upper left corner of the screen. If the bearings are good, that is where the transmitter is. Even if the APRS map has errors in the location of roads and towns, the coordinates obtained by triangulation are correct if the coordinates of the RDF stations have been correctly entered.

Now that the APRS base station has coordinates for the unknown signal, its operator can notify mobile transmitter hunters. Better yet, the base station can automatically transmit a stream of packet transmissions with bearing data to a group of mobile transmitter hunters running APRS and their own Dopplers. The mobiles must input their locations and vehicle headings to APRS for bearings to be plotted. Although this can be done manually, the best way is with the NMEA-0183 output of a Global Positioning System (GPS) receiver.

Since most laptop PCs have only one or two serial ports, hooking up three peripherals (TNC, GPS and Doppler) poses a major roadblock. WB4APR has created a Hardware Single Port (HSP) mode to permit GPS and TNC to share one port. You will need to build a two-transistor data switch, activated by the Data Terminal Ready (DTR) line on the serial port. Details and circuits are in the README.GPS file in APRS documentation.

To work with the serial RDF interface, your copy of PC-APRS must be registered with a DF validation, which costs an extra nine dollars over the regular APRS registration fee. However, there are other ways to get RDF information into the APRS screen without special registration. Any base or mobile station running APRS can manually put its RDF bearing into its station position report to be transmitted on packet. An APRS operator can also get RDF bearings and positions of other base and mobile stations via voice radio, then enter and transmit them on packet from his station.

Packet stations not running APRS can put their RDF bearings in their beacon texts. If formatted properly, APRS-equipped stations receiving the beacons will automatically receive and display the bearing lines. The APRS README.DF file gives detailed explanations of how to do all this.

The README.DF file also describes how to set up remote, unattended RDF stations consisting of a receiver, Doppler, serial interface, and packet TNC. No computer is needed if the TNC is set up to properly format and beacon the RDF data. Three of these stations at good receiving sites around a city could give any APRS station in the area instant triangulation data whenever an unknown signal comes on the air.

WU2Z has provided excellent RDF features in MacAPRS, such as mouse-drawn bearings with range and exact coordinates indicated in a data box. However, the Doppler inputs are just partially implemented as of this writing and I have not had an opportunity to try them on my Mac as yet. Keith says that MacAPRS bearing quality is indicated by line color, not "dottedness" as with the PC version. He has not incorporated the HSP mode, but is looking for ways to do it, perhaps by the time you read this. The basic MacAPRS registration includes serial Doppler data input.

Get in on the Ground Floor

APRS and its interface to Dopplers and GPS are not a "plug and play" system yet. The hardware and software are constantly evolving in response to user feedback. Every ham's APRS installation will have unique challenges due to differences in computers, Dopplers, TNCs, and GPS receivers. There are important control and local QRM issues involved in setting up remote RDF sites. Your experiences and suggestions are needed to optimize the bearing averaging algorithms.

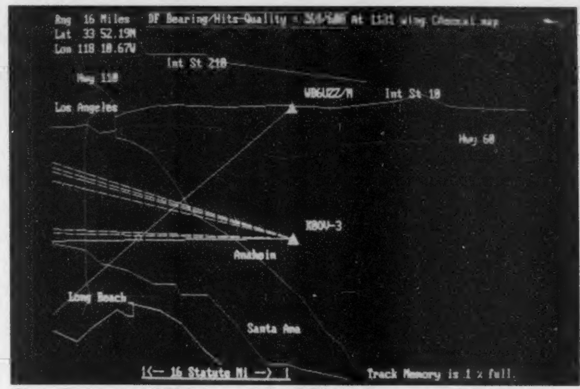


Photo B. A typical APRS base station RDF display on a color PC. A southern California APRS map with more detail is available, but a rudimentary map is shown here to make the bearings stand out clearly.

There is no way that "Homing In" can cover all the nuances of setting up APRS RDF networking. You will need to read the voluminous APRS documentation and plan your installation carefully. This effort will pay off in your being the "first on your block" to use a revolutionary RDF technique that may someday become a commonplace way for hams to perform public service and self-policing.

Both APRS authors welcome your questions and constructive suggestions. E-mail is the best way to communicate with them. If you write, enclose a self-addressed stamped envelope for the reply. Allow some time for a response, as they are very busy hams. Let me know your RDF ideas and experiences, too. Write to me at the address at the beginning of this article or send E-mail to me via Internet [HomingIn@aol.com] or CompuServe [75236,2165].

Resources for RDF with APRS

Hardware for the Doppler-to-RS-232 interface is available from Robert Swain N7LUE, 360 Phirne Road, Glen Burnie, MD 21061 [CMPK59D@prodigy.com]. Bare boards are $15 each, board-and-parts kits are $49, and an assembled/tested interface is $69. Add $3.00 for shipping. State your model of Doppler unit when ordering. Prices are for Version 1 boards without data mute circuit; future boards/kits with this feature may be slightly higher. Kits include sockets for all ICs. Due to wide variations among computers, an RS-232 connector is not provided. Power requirements are +5 VDC at 85 mA.

Complete plans for the inexpensive Roanoke Doppler RDF set are in *Transmitter Hunting—Radio Direction Finding Simplified* by Joe Moell K0OV and Tom Curlee WB6UZZ. This 323-page reference (TAB Books #2701) covers all aspects of RDF and is available from Uncle Wayne's Bookshelf. Antenna system improvements are in "Homing In" for April and June 1995.

Bare circuit boards for the Roanoke Doppler control/display circuits are available from Tom Lewis AB5CK, 6721 Rolling Hills Drive, North Richland Hills, TX 76180 [tlewis@dfw.net]; and from Marty Mitchell N6ZAV, 340 Otero, Newport Beach, CA 92660 [n6zav@netcom.com].

A line of wired/tested Doppler RDF displays and antennas for bands from 108 to 1,000 MHz is sold by Doppler Systems, Incorporated, PO Box 2780, Carefree, AZ 85377; (602) 488-9755. Some models include RS-232 data output in ASCII format; the N7LUE board is not required for APRS interface with them.

For detailed descriptions of PC and Mac versions of APRS and their use with GPS receivers, see "Homing In" for October 1994, January 1995, and February 1995. The programs are available via modem from many online services and on disk from the authors for a nominal fee. New versions are posted first on the primary sites.

An Internet message reflector (mailing list) is maintained by TAPR for APRS experimenters. Subscribe by sending a one-line message to listserv@tapr.org with the text "subscribe aprssig <your E-mail address>" and nothing on the subject line.

As of this writing, the latest version of APRS for PCs is 6.9. Primary site is the Annapolis BBS at (410) 280-2503. Registration fee is $24 plus $9 each for optional GPS and Doppler serial inputs. Disk fee is $9. Author is Bob Bruninga WB4APR, 115 Old Farm Court, Glen Burnie, MD 21060 [E-mail via the TAPR aprssig].

As of this writing, the latest version of APRS for Macintosh is 1.5.5. Primary site is ftp.tapr.org directory /tapr/sigs/aprs. Registration fee is $30; disk fee is $10 (high density). Author is Keith Sproul WU2Z, 698 Magnolia Road, North Brunswick, NJ 08902 [ksproul@noc.rutgers.edu].

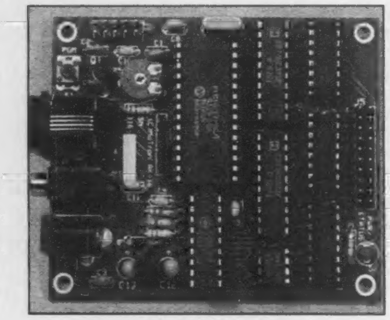
Number 26 on your Feedback card

NEW PRODUCTS

Kantronics
PacketCommunicator 3
Power
Xmit
Rcv
Con
Sta
Mail

KANTRONICS

Kantronics has announced the release of Version 6.0 of its KPC-3, which offers some of the most powerful GPS (Global Positioning System) capabilities available in a TNC. To receive and re-transmit GPS data, the KPC-3 connects to GPS receivers with NMEA-0183 interfaces. Its user-friendly GPS capabilities are highly advanced for maximum performance and flexibility; users select as many as four of the GPS unit's NMEA data strings; GPS data can be stored for later retrieval and is accessible via the KPC-3's mailbox; users specify beacon start time and amount of time between beacons, so that multiple stations report without collision; the system operator can reconfigure the GPS unit from a remote location; and it's APRS compatible. Also, Kantronics has a low-cost EPROM upgrade available for earlier versions. For the price and more information, contact *Kantronics, 1202 E. 23rd St., Lawrence, KS 66046; (913) 842-7745, FAX (913) 842-2031.* Or circle Reader Service No. 201.



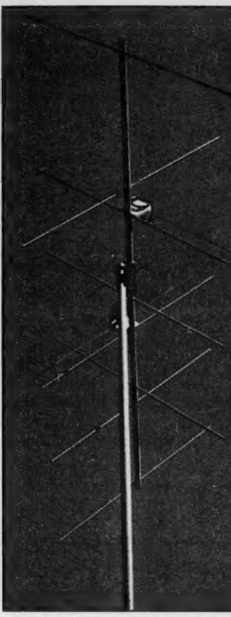
MOTRON ELECTRONICS

The Auto-Kall AK-16 is the newest member of the MoTron Auto-Kall product line. It is a DTMF controller with 16 relay driver outputs, DTMF to X-10 home control, CWID, and Morse response tones. A relay board with screw terminal blocks, sold separately, can directly mate to the AK-16 for easy set-up.

All 256 X-10 house/unit codes can be addressed, letting you control lights, appliances, gates, etc., with the DTMF keypad on a handheld or mobile radio. You can also configure outputs for several different modes of operation. One mode makes it possible to control easily the pan/tilt focus/zoom functions of a remote video camera and also provides latching outputs for controlling transmitters, lights, etc. The AK-16 can be configured with a Morse response after each output is turned on or off, or triggered momentarily, assuring you that the command was received and executed. You can also program the 0- to 12-digit security code and 32-character CW ID using a DTMF keypad. The AK-16 furthermore has a serial output that converts incoming DTMF to ASCII for input into your computer.

The AK-16 is sold as a fully assembled circuit board. The price is $99 and is available from *MoTron Electronics at (800) 338-9058, FAX (503) 687-2492.* Or circle Reader Service No. 206.

WOODHOUSE COMMUNICATION



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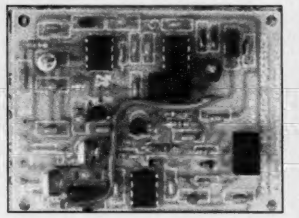

From Australia comes the CEC model SP-500 RF Speech Processor Plus, designed to help achieve maximum performance from SSB radio equipment. It can provide an 8-dB increase in a signal's readability under weak and noisy reception conditions, having the same effect as more than quadrupling your transmitter output power. The SP-500 incorporates such features as multimode "E/K" End of Transmission Beep (ETB) generator, LED bargraph level indicator or bypass switching to allow for "with" and "without" comparison tests. The SP-500 RF is priced at US$210 plus freight from Australia.

Using circuitry similar to the SP-500, the little SP-100 RF also packs as much punch. Both units bring the amplitude of the low-level component up close to that of the peaks, thereby decreasing the average-to-peak power ratio. Because they do this at RF, using their own internally generated SSB signal, they produce a much cleaner output waveform and more talk power than any audio processor or power amplifier microphone. With the SP-100, however, installation is simplified by the fact that it connects in series with the microphone's audio line. The SP-100 RF is priced at US$75 plus freight from Australia. For more information or to purchase either item, contact *GFS Electronics, P.O. Box 97, Mitcham, 3132, Victoria, Australia; 61-3-9873-3777 or FAX 61-3-9872-4550.* Or circle Reader Service No. 204.

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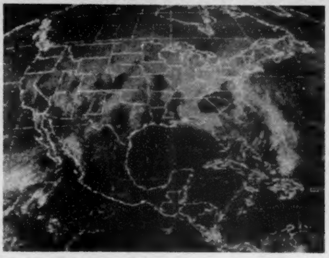

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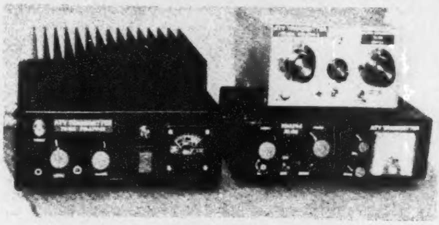

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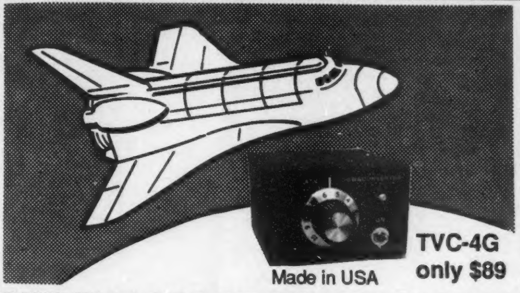

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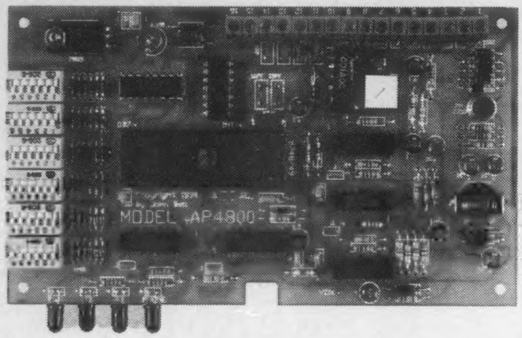

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5	Antennas West	65
324	Antennas West	84
304	Antennas West	80
340	Antennas West	77
282	Antennas West	78
296	Antennas West	31
380	Antennas West	78
•	Antique Radio Classified	76
80	Arrow Antenna	77
16	Astron Corporation	21
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56	Buckmaster Publishing	17*
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222	Byers Chassis Kits	78
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•	Centaur Electronics	17
265	Chipswitch	65
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99	Communication Concepts	76
•	Communications Data Corp.	51
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268	Computer Automation Technology	22
•	Davis RF Co.	84
•	Down East Microwave	9
114	E. H. Yost	17
75	Fair Radio Sales	65
•	Gem Quad	65
193	GGTE	31
286	Hambrew Magazine	78
•	Ham Radio & More	35
•	Hamtronics, Inc.	7
345	HamWindows	65
293	IC Engineering	17
179	ICOM America, Inc.	CV2*
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55	J•Com	33
•	Jade Products	51
27	John Bell	72
•	K-Comm	51
•	Kantronics, Inc.	5
2	Kawa Productions	84
151	KDC Sound	77
•	Kenwood USA Corporation	CV4
234	Lentini Communications	53
•	Meadowlake Corp.	65
•	Memphis Amateur Elect.	83
86	MFJ Enterprises	11
86	MFJ Enterprises	37
160	Micro Computer Concepts	85
144	Micro Control Specialities	73
30	Micro Vidio Products	79
193	Morse Tutor Gold	31
248	Motron Electronics	15
114	Mr. Nicad	17
54	NCG/Comet	2
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198	Personal Computer Repeater Controller	79
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49	Polyphaser	85
257	Quorum Communications	23
153	Radio City	88
•	Radio Control Systems	57
58	Radio Engineers	84
•	*Radio Fun*	72
•	RAI Enterprises	77
34	Ramsey Electronics	61*
•	RF Applications	41
254	Ross Distributing	78
•	RT Systems	84
•	SAMS	84
36	Scrambling News	80
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188	SGC Inc.	53
92	Shack Attack	80
250	Software Systems	71
69	Spectrum Electronics	79
183	Spectrum International	83
247	Startek	1
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•	The Ham Store	51
384	The Ham Contact	57
384	The Ham Contact	9
269	Tigertronics	72
•	T.J. Antenna Company	17
•	Tower Jack	85
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Continued from page 4

a navigator who can help the driver follow the route instructions, which often are misleading, and keep exact track of the time and distance despite frequent speed changes in the instructions. You can see why a good watch and calculator are necessary. We get irritated with today's digital watches if they are off by a mere few seconds a month.

Not only did I import the watches, but I also adjusted them for the needed accuracy.

When I moved from New York to New Hampshire, I left rallies behind. I've some great rally stories to tell, but I'll save them for my memoirs. As president of the Porsche Club of America,I put on rallies that the participants still talk about. Ask John Freels WB0FBK, if you run into him on the air.

Whatever I get interested in, I seem to find some way to be an entrepreneur.

Right now the cold fusion field needs information, so I'm gathering and selling it. When I was into computers I published magazines and books, started a couple of software companies, started a string of software stores, and so on. When I published music magazines I built my own recording studio, started several record labels, got into brokering CD manufacturing, and so on. I can't help it. Besides, it's all fun!

This All Started . . .

...a couple of months ago. I'd gotten word that the first patent had just recently been issued in the cold fusion field. Some inventor named Jim Patterson down in Sarasota, Florida, had pulled off this coup. This was all the more remarkable because someone high in government seems to have been putting the hex on cold fusion.

The Patent Office has had orders from someone not to issue any cold fusion patents, so there are hundreds of applications backed up. The Department of Energy (DOE) seems to have orders not to grant any research funds to any school or organization that is permitting any cold fusion experimenting to be done. This has caused terror throughout the universities that some undergraduate might run an experiment which could be construed as being cold fusion oriented and thus lose the university millions in research funds.

Indeed, I read in the Rensselaer newsletter that students there had successfully confirmed the Pons & Fleischmann claims of excess heat from palladium and deuterium. But my several letters requesting further information have remained unanswered, even though I have been a major contributor to the university, was their first Executive in Residence, and serve on the RPI Council and the Board of Overseers.

I called Jim Patterson to find out more about his patented cold fusion cell. It seems that he sneakily did not mention cold fusion in his patent application, but did show substantial excess heat in the data he presented. He'd already had patents issued for his process for manufacturing microspheres, and this was just an add-on to those earlier patents. Also, Jim being a very old person (my age), the Patent Office has a separate track for patents where the applicant could well die of old age waiting for them to act. So he promptly got his patent.

Jim mentioned that Dennis Cravens, a teacher from a small community college in Texas who has been doing cold fusion research in his garage with his own money, and as a result is one of the leading American researchers in the field, would be coming to Sarasota in a few days to confirm the excess heat generated by his cell. I went down to watch.

I used to live in Sarasota, where I worked as an engineer-announcer at WSPB. But that was 45 years ago, so I found things had changed. For instance, my old radio station is run by cartridges, with almost no staff needed.

Dennis had been delayed a week, so I had plenty of time to meet and talk with Jim. I sure wish he was a ham so we could talk without the telephone company making so much money. Jim is a fascinating chap. What he'd done is take his polymer microspheres and give them a very thin coating of palladium, so that his cell had the greatest possible amount of palladium surface area per unit volume. The result was that, when he passed a current through it, the palladium metal lattice structure absorbed the hydrogen in minutes instead of days to weeks. Researchers have found that it's necessary to get around 85% of the palladium volume loaded with hydrogen before the excess heat action starts.

So here was a way to get excess heat generated in minutes! Jim had a setup running and I checked the instrumentation. Sure enough, it was putting out several times more energy than was being used to trigger the action. Dennis arrived a few days later and confirmed everything.

Since the fifth annual cold fusion conference (ICCF-5) was coming up in a few weeks, Jim and Dennis put together a working demo system in a clear plastic box and shipped it to Monaco for the conference. They set it up there and had it perking for the four days of the conference just outside the big meeting room. It was turning out a minimum of 300% more energy than going in, and towards afternoons up to 600%. And that didn't even count the heat lost to the air of the room from the cell, the heat from the escaping oxygen and hydrogen gasses, and the potential heat from recombining them.

If there were any skeptics about whether cold fusion works, this exhibit at the conference should shut them up. The instrumentation and readings were checked by scientists from 15 countries and the results confirmed. However, I'm put in mind of the little problem Galileo had. His fellow scientists refused to look through his telescope. Pasteur had the same problem when he tried to convince the scientists of his day that there were germs. He couldn't get them to look through his microscope. Today many scientists are so completely convinced that cold fusion is impossible that they won't even look at a working demonstration.

The Patterson patented cold fusion cell is just the beginning. Lacking an accepted theory as to why the excess heat is happening, researchers are working empirically. They need to test other metals, electrolytes, temperatures, pressures, voltages, RF excitation, and so on. Will this work better at 300° C than at room temperature? And so on.

Jim has improved his microspheres by first coating them with copper as a base, then nickel, a layer of palladium, and another layer of nickel. The nickel keeps the palladium from flaking off, and it loads with hydrogen almost as well as palladium. The minute amounts of palladium needed for the cells saves money over using palladium bars or sheets.

But here's an area of research that any inventor could get into for peanuts and have a good chance at coming up a big winner. Bill Gates saw his opportunity when the microcomputer industry was at about this level of development. He'd written a Basic interpreter for the 8008 chip as part of his lab work at Harvard. Then, when the MITS Altair 8800 computer was introduced and was in desperate need of software, Bill left college to work at MITS and the rest is history.

Steve Wozniak saw the need for a single-board computer instead of the old mother-board system with plug-in modules for everything. He cooked one up at home. Steve Jobs saw the potential and together they made hundreds of millions. Gates made billions. History is all set to repeat with the cold fusion field except that it is going to grow to a hundred times the size of the computer industry. It's going to shoot into the trillions.

I was there right from the first in the computer explosion, publishing magazines. I'm doing the same in the cold fusion field.

Monaco

Around 200 scientists gathered for the conference. I already knew most of them from the last conference on Maui, so it was fun getting together again to talk. Six members of my board of scientific advisors where there . . . from Belarus, France, China, India, Japan, and the US.

Yes, of course I got a 3A/W2NSD ticket so I could get on 2m with my HT. They do have repeaters in France and Italy that can be reached from there, but the conference kept me too busy to operate as much as I'd have liked. Papers were being presented all day long, and then in the evening I read through other papers, read a few relevant books I brought along, and even managed some writing with my laptop.

Most of the papers presented at the conference showed progress, but none were as eye-opening as the Patterson demonstration. And that was the only live act.

Sherry and I made the trip via London, stopping off for a day of rest, seeing two London shows, and getting together with Ray Howes G4OWY, who is both a *73* and a *"Cold Fusion"* reader. From there we took the Chunnel train to Paris. It topped out at 187 mph, whipping through the Chunnel in no time. It turns out there isn't much to see in a tunnel unless you are in Disneyland or Coney Island.

The trip to London was a long one. Sherry used the flier miles garnered by using our MasterCard so we could go first class. We charge every business expense we can to the card so we can fly for free on the flier miles. But the only seats available forced us to fly to Houston from Boston, and then on to London. That added about eight extra flying hours. Flying and feeding hours, actually. In first class, they keep the food coming. By the time we got to London we'd eaten our fill and had enough left over to carry us for a couple more days.

The next day, after getting to Paris, we took the high-speed TGV train to Nice, and then the local to Monaco. Monaco is fine, except for two things. If you don't gamble there is almost nothing to do. But they made up for that with high prices. Would you believe $4 for a Haägen Dazs cone? A painful place for a known skinflint like me to visit.

We did take a bus tour where we visited a perfume factory with a huge sales room, and the scene of Princess Grace's fatal accident. And that was about it for Monaco. My bags were so stuffed and loaded with the most recent issue of my cold fusion magazine that I didn't have room to bring a low band ham rig and antennas. Nor the time to get on the air if I had.

The trip did give me an opportunity to finish Lerner's *The Big Bang Never Happened*, which I've mentioned before. It completely demolishes the Big Bang Theory of how the universe started. But even more important, Lerner's explanation of how solar systems get started made sense. He shows the equations involved in the plasma-like action that forms them and then goes on to show that the exact same forces have formed the galaxies and then—going up another level of abstraction— the super galaxies.

The same equations also work for laboratory-sized plasmas, and are derived from fluid mechanics. This is the same source that Maxwell used in deriving his famous equations for magnetism and radio waves. But the thing that really hit me was the concept of the plasma, with its tight vortex in the middle spinning down, then spreading out and back up to go down the vortex again. This was exactly the same drawing I'd seen in Phillip's *Direct Perception of Quarks!* This stemmed from the work of Besant and Leadbeater as published in 1895 when they meditated on the makeup of the atom. They were able to break it down into what we today call subquarks and describe their action as we know it now. And it was exactly the same as that generating solar systems and galaxies!

Here might be the answer to cold fusion! The main problem has been how to get two protons to get together, and that meant overcoming the Coulomb Barrier between them. Physicists have believed that the only way to do that is to get the atoms up to hundreds of millions of degrees so their energy would be enough to break the barrier. Thus the $10 billion or more so far invested in hot fusion research.

But suppose the energy generated in the plasma vortex is enough to break that barrier! That would allow fusion to take place on a micro-scale, giving us the heat we see.

This would also help explain why scientists have been seeing similar results from sonoluminescence and hydrosonic research. And it would tie in with the scientists preaching ball lightning and plasmoid action.

I've run my theory by several experts and have been encouraged to propose it in my magazine. The idea of a non-scientist like me solving a problem which has been baffling Nobel prize scientists is exciting, but I'm prepared for the bubble to be burst. It does make sense on a conceptual level, so we'll see. It helps tie a lot of loose ends together.

I'll tell you this, if I was maybe 10 years younger I'd be setting up my own lab and going after some patents. The field is wide open and there's almost no competition in America. It's the Japanese who are making the most progress, but then their government is supporting them. Now, I wonder who it is in our government who has put us so far behind, and who paid him to do it?

Pons & Fleischmann

They got so angry when they were humiliated by the media after several labs were unable to confirm their cold fusion reaction that when Toyota came along and offered to build them the lab of their dreams anywhere in the world, they left the country. They're now happily working in their $10 million lab on the French Riviera, not far from Nice.

A year ago, on a BBC documentary, Dr. Fleischmann showed a cell a little larger than a Thermos bottle. "How much power can you generate with that," he was asked. Dr. Fleischmann responded,"Oh, about 10,000 watts." The interviewer then said, "And how often will you have to refuel it?" The answer: "About every ten to the fifth years."

Pons and Fleischmann were completely silent about their progress at the Monaco conference. Indeed, they locked up their nearby lab so no visitors could see it for the duration of the conference. This bolsters my suspicion that Toyota will be coming out with a car in a few years with a sealed engine that will never require any fuel. Just think what that will do to the car market! It'll go 100% imported cars in short order.

A ham introduced himself at the conference: He said he was there from Wall Street, looking for potential investments. Well, even at this early date the sharks are circling. I watched one guy I personally know to be a real sleaze sneaking around, talking with scientists, urging them to do business with his company.

Oh well, this isn't really ham stuff, so you're probably not interested. Please forgive my enthusiasm and my pushing you to get involved with making money. It's just that money is so easy to make if you keep your eyes open and go with the tide instead of fighting it.

Disneyland — Paris

Since Sherry and I have done the Anaheim, Orlando, and Tokyo Disneylands, it seemed only reasonable to take a day on the way back home and see how the Paris Disneyland stacked up. We did not pick a good day. Easter Sunday was cold (40°), overcast, and windy. And the place was packed solid. We didn't even try to go on most of the rides. For instance, the train around the park had a one-hour waiting line. And then we found that it went behind most of the park areas so there was little to see on the ten-minute ride.

What surprised us the most was the food. The food at all of the other Disney parks has been first rate. Here it was simply awful. Of course it made up for the poor quality by being expensive and our having to wait in long lines to get it. Imagine 50 people in line for a simple ham and cheese sandwich. At most of the food places it was like McDonald's when ten tour busses stop at the same time. Mobs twenty people deep.

The entry fee to the park was about $50 each. Oh well, now we've been there and done that.

Do You Dare?

You've read about people who are so terrified of going out that they never leave their homes or apartments, even having all their food delivered. Well, many of us are imprisoned like that by our minds, keeping us from venturing out of our comfortable, self-constructed worlds. Our habits help imprison us. The aim of most of my editorials is to open doors for you so you can get a peek at what's out there in the way of adventure and excitement. Fun.

I try to entice you into trying new things. New Ideas. New modes. New bands. I despair when I talk to hams who have spent their ham lives on just one band, or just with CW, or phone. Here, look, I say, how about trying this? And I point out that I know it's fun because I've done it. I've been there and done that, so I know you can, and I know you'll have a ball doing it.

Some readers react by saying, hey, maybe Wayne's right, I should give that a try. Others, looking for an excuse to do nothing, say that it's just Wayne bragging again.

My father was a difficult man. He made life miserable for my mother. If she prepared the same breakfast twice in a month he'd rage about getting the same thing every morning. So breakfasts were always a surprise. Fried mush with New Hampshire maple syrup, Philadelphia scrapple, eggs Benedict, poached eggs on New England red flannel hash, corn muffins,

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corn pancakes, French toast, and so on.

It was the same for dinner. No restaurants provide such a varied menu as mother served. It might be bratwurst, pigs knuckles, turtle steaks, hash, roast pork, duck stuffed with peanut dressing, lamb shanks, and so on. Meals were an adventure. I don't think she ever served hamburgers or plain old hot dogs. It might be a ham slice with Boston baked beans and Boston brown bread.

I remember when I went on my first Boy Scout camping trip to Staten Island. They had forests over there. The other Scouts cooked hot dogs over their fires on pointed sticks. I brought along the makings and whipped up a delicious lamb stew over my fire. It never occurred to me to bring hot dogs.

So, here I am, doing my best to get you to enjoy some of the things I've enjoyed. Whenever I discover something that's fun or exciting, I have a need to share it. I want everyone else to experience that same feeling of excitement. So I write about the books I've read that are just too wonderful not to share. I write about hamming over our satellites. I write about scuba diving and skiing. They're both enormously exciting activities. The English language is terrible when it comes to trying to express feelings, so I don't know how to explain the thrill of being a good skier and heading down a hill at breakneck speed. Or racing a Porsche on the Nürburgring. Or going on an African hunting safari. Or exploring the fun of ham teletype. Or visiting Swaziland and Lesotho and getting on the air to tackle the pileups.

As I've mentioned recently, I finally sat down and made a list of the different ham activities. I was able to come up with 53 different activities that I've enjoyed, and 20 more that are still ahead for me. Every one of those is fun and it's a rotten shame that so many hams are stuck in one little corner of this grand hobby.

When I give talks I often ask for a showing of hands for different ham activities. How many here have made two meter aurora contacts? How many have been on our ham satellites? How many have ventured above 450 MHz? How many have mountain-topped on VHF? How many have worked over 300 countries? How many have won the Sweepstakes contest for your area? A DX contest? A VHF contest? How many have worked cross-band contacts? And so on.

Frankly, I get discouraged when I see so few hands go up. How many of you have been on a DXpedition somewhere? A couple hands. Doggone it. It doesn't cost much to go someplace and work the pileups. St. Pierre is near the east coast and easily accessible. The Caribbean is packed with small countries that'll generate pileups. If anyone thinks it costs a bundle to visit these places, they haven't been reading my editorials or my Uncle Wayne's Travels reports. Yeah, they're chintzy. I write the stories of my travels on my Macintosh, print 'em out, and then photocopy the reports. Well, they sell by the dozens, not by the zillions, so that's the only practical way to do it.

In my reports I show how thriftily (cheap) one can travel. How about a trip Sherry and I took to Munich, where we rented a car, drove to Vienna, Krakow, Prague, and back to Munich in the middle of the winter. We had first class seats flying over and back, and the whole works, including the car, hotels, some great meals, and wonderful visits with the hams in all those cities cost under $1,000. Impossible? Heh, heh, not when you know how to travel thriftily.

A couple of years ago we made a fantastic birthday present trip down through 11 Caribbean islands, meeting hams, getting on the air, and scuba diving most of the islands. The whole thing cost peanuts. Yes, I've written up day-by-day reports. I wrote 'em up for friends, but when I sent copies to some readers they wanted more for friends, so I made up a bunch and I've been selling 'em.

When Sherry and I arrived at the Mbabane airport, I said, "Wow, I sure wish there was some way to get more hams to visit a fantastic place like this!" I said the same thing when we visited a native longhouse in the mountains of Sarawak, complete with their enemy tribe's skulls hanging in the big meeting room.

Yes, I've eaten the poisonous blowfish in Japan and fried baby birds in China. I'm game for just about anything on the menu in any country. How about you? Hamburgers, eh? And are you the one who's been on 75m phone checking into the same net for the last few years? Are you the one stuck up there on 2m with a Tech ticket? I've been listening to you when I visit your area and I don't hear much different from what I'm hearing on CB, except that sometimes the language is worse on 2m.

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So I'm going to keep right on bragging about the things I've done that I've found exciting, hoping I can get you to reach for that door knob and peek out.

In my music magazines I've been doing the same thing. There's an awful lot of rotten music out there, and a few really exciting pieces. A few real gems. So I listen to as many new CDs as I can, and when I find something which really gets to me, I do everything I can to get others to at least give a listen. I'm put in mind of poor old Galileo, who couldn't get his fellow scientists to even take a look through his telescope.

Not that the situation is much different in the cold fusion field, where old-

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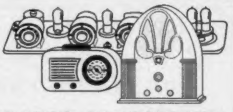

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line scientists who "know" that cold fusion is impossible because there's no theory which can explain it refuse to look at the results of laboratory tests. They "know" that if excess heat has been claimed to be produced, the experimenters must have made some stupid mistakes.

So you can put my urging you to try 75m DXing or working a few states on 10 GHz down to the same old Wayne's bragging, or you can accept it as I've been there, done that, and it's fantastic fun you shouldn't miss. I'd tell you (again) about the astounding CDs I've produced of Scott Kirby playing Scott Joplin's music, but my legions of detractors would claim that I'm just trying to make another buck. Since money has never been a driving force for me, that almost gets me upset. Don't you hate it when someone accuses you falsely? Surveys of entrepreneurs have always shown that they are driven by the need for results, and not money. So I'll keep trying to get you to enjoy the things I've found exciting and the heel-draggers will point in disdain at me bragging and trying to sell my book, booklets, CDs, and so on. Your choice. But you'll live a lot longer if you have fun with me than if you hate. And you'll be a lot better person with whom to live and work.

When I get angry letters, I'm sad because I know that this person is an angry person and I'm not the only target by a long shot. His wife, kids, and coworkers have to share his anger, and he's shortening his life.

Speaking of money, if it had been important to me, I'd probably have shot myself when someone I trusted did me out of over $100 million. I didn't smile, and it was a terrible shock, but I lived through it. I lived through a $20,000 fine from the IRS (over 20 years ago) for something that they knew I hadn't done. And I've lived through a more recent plot by some trusted employees to put me out of business and take my publications away. Heck, 40 years ago I lived through a partner destroying a $20 million business I'd built from scratch. And I'm still smiling and enthusiastic about doing new things.

For instance, I've been listening to Rush Limbaugh during my lunch-time drive to and from the office in Peterborough. He's got one heck of a big audience. Well, I think I can put on as good or better a show. I've got endless ideas on how we can fix most of our more serious social problems, such as how to eliminate drugs as a major American problem. How to cut our prison costs by at least 90% and have the criminals help fund our police and court costs. How to cut health care costs by over 90%. How to get our bureaucracies to cut their costs to us by 50% within three years and enthusiastically help to do it. How to make Congress actually turn honest. How America can provide almost any amount of foreign aid and make a mint doing it as well as improving the world. How to end welfare with everyone winning. Stuff like that.

A good positive approach to our problems might actually get people to start thinking in terms of improving our country and states, and to come up with even more creative solutions to our problems. I'm certainly not the only one who can do that. It's just that there is no forum for anything that's innovative.

I'd also be pushing hard to get every school in the country to form a radio club, and to help kids to get their ham licenses. But then, I'm anxious to completely reinvent our whole school system and make it so kids can go to college with no tuition required (and no public funding, either). I'd be reviewing exciting books I've found, great music most people have missed hearing about, and so on. I'm a pretty good salesman; otherwise, my talks at Dayton wouldn't always pack the room. I've always pulled the biggest crowds of any speaker. I'm enthusiastic. I'm selling fun and excitement. And I know what I'm talking about because I've been there and done that myself. I've done my homework.

A talk radio show sounds like fun, but Sherry points out that at 73 years old, and busy editing and publishing *73*, *Radio Fun*, *"Cold Fusion,"* and a bunch of other things, I haven't got the time to do a daily radio show also. She also points out that it took Rush years to build his big audience, and I probably haven't got that many years left. Further, a daily show would keep me from traveling. She's right. Well, maybe I'll just make some tapes of the shows I'd like to do, and settle for that.

I'll next be performing at the Edmonton Hamfest (Alberta, Canada) on July 1. Well, the Dayton HamVention gang seems to be so angry with me for not exhibiting for a couple of years that they're not about to ask me to speak. And the ARRL has always done all it could to keep me away from their conventions, and they control almost all of 'em. Unless there's a conflict with my schedule, I generally accept speaking requests where they'll pay my expenses. At one time I charged $1,000 plus expenses, but that brought me so many requests to speak that I had to stop charging. Jean Shepherd K2ORS, undoubtedly the best ham speaker in history by a huge margin, said he got far more attention and requests to speak once he set a stiff price on his time. And he was treated like royalty instead of dirt when he spoke.

What can I do, for instance, to get you to try your hand at using some of our ham satellites . . . and then writing about it so we can get more hams to try 'em? Or are you so used to eating the same breakfast every morning and hamburgers for lunch that your sense of adventure has atrophied?

Anyway, check out my travel reports in the Uncle Wayne's Bookshelf ad, and you might even want to suck in on my non-Dayton 90-minute tape talk. Or not.

Long Ago

When I first moved *73* to New Hampshire from Brooklyn in 1962, just

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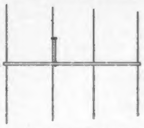
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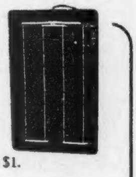
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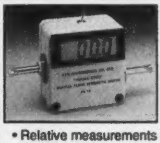
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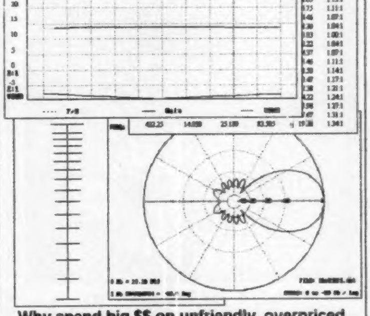
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two years after starting it, I hired a bunch of college-dropout hams to come work for me. I paid $20 a week, plus room and board. I had up to eight hams living in my 40-room house and we had a great time. I cooked the meals, we put out the magazine, and we set up one heck of a ham station way up on Mt. Monadnock, a few miles away.

When I bought a small offset press, we started also putting out a small VHF magazine, a contester's magazine, and one for club newsletter editors. High school kids came in after school and helped collate, staple, and address these publications for 50¢ an hour. They got some spending money. It helped keep them out of trouble. And they got to learn about the responsibilities of working.

I had one ham working with us who was so much trouble that I finally gave up and tried to fire him. He pleaded with me to let him stay and keep working without any pay. Being a sucker, I said I'd give it a try. After a couple weeks I told him he wasn't worth anything. He then offered to pay me $20 a week if I'd let him stay.

I finally agreed to let him stay if he'd live in my house up on the mountain and help clean out the brush around the place. Just don't come down and aggravate us here. Well, for instance, I did the cooking and the live-in hams took turns washing the dishes. When it was Tedsy's turn he managed to turn a half-hour job into a four-hour job. The same when it was his job to empty the wastebaskets or shovel out the horse stalls.

Tedsy came down from the mountain one day and asked if I minded if he put up a vee beam for six meters, aiming it down the east coast. What could go wrong? I said sure. The next thing I knew a few weeks later he'd cut down a couple dozen big trees to make a path for the two legs of his vee beam. Worse, he'd miscalculated a bit and the beam was actually aimed at Bermuda, so no one down the coast could hear him.

I remember him walking up with a broken yardstick in his hand. He looked at me sheepishly and explained that he'd had it in his mouth and walked through a 30" door.

One day the government arrived. They'd had a complaint about my paying less than the minimum wage. I pushed them to find out where the complaint had come from and they said it was the ARRL in Connecticut. They said I'd have to stop paying the hams with the room and board and $20 a week, pay them regular wages, and charge them for the room and board. And the after-school kids would have to get at least the minimum wage.

I automated the collating and addressing of the publications I was printing, thus getting rid of the school kids. The hams were replaced by local people doing most of the work. No more room and board. No more fun. And without the gang to keep the ham shack up on the mountain operating, I closed it down and sold the place. Well, we all had the time of our lives while it lasted. Several of my alumni have gone on to be successful entrepreneurs.

You better believe that the lobbyists in Washington from Mexico and other low-wage countries are pushing congress hard to increase our minimum wage. Every dollar it goes up will mean millions for their countries, and more welfare and unemployment problems for us.

One alternative is to improve our school system so we'll have better-educated and better-skilled workers to enable us to compete more effectively internationally, but here we're up against the most powerful lobbies in the country, the teacher's unions. And they're unfailingly supported by the mass ignorance and apathy of voters.

Say, if we move the minimum wage up to $15 an hour we'll no longer have any poverty, right? Who could possibly be against that? If they move it to $20, I might even consider working again.

Help Wanted

Ham nirvana is "working" for a ham magazine, where you get to play with the latest in ham gear and help guide the whole hobby. We've a spot open for someone as an assistant tech editor. This will include updating the W2NSD/1 ham shack and getting it top notch with packet, satellite communications, SSTV, our repeater, our BBS, and one whopping signal on 20m. And how about a nice apartment we have available right next to the station? One with an incredible view looking out over the New Hampshire mountains? Yes, we'll actually pay someone to do this. We really should be charging for something this great.

If you're interested, drop me a line telling me about your ham experience, tower-climbing agility, and assuring me that you are *not* a smoker or an alcoholic. Address it to: *73* Tech Assistant, 70 N 202, Peterborough NH 03458-1107.

Get Rich Slowly

Getting your articles published in *73* and *Radio Fun* has a couple of benefits. Firstly, there's the pittance we pay for articles, which you can blow all out of proportion to your family and friends, proving to them that amateur radio not only is fun, but is profitable, too. Bene #2: If you ever go for a new job, you'll find that every published article you can show will, on the average, result in about $1,000 more per year in your paycheck. Nice cumulative benefit. A bonus is the adulation you will get on the air and at club meetings.

What kind of articles? Well, of course the most popular, even with parts so hard to find, are simple construction projects. DXpeditions and ham adventures make great reading, too. We're always looking for interesting reports on new equipment, plus any fairly simple modifications you think might benefit others. And I would like nothing better than to have some guest editorials I could publish (for free). ■

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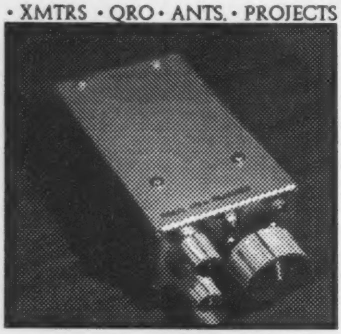

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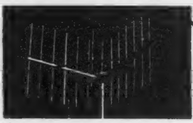

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Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the April issue, we should receive it by January 31. Provide a clear, concise summary of the essential details about your Special Event.

AUG 6

WELLESLEY, MA The Wellesley ARS and the Babson Wireless Club will co-sponsor a Hamfest at Babson College's Pepsico Pavilion, 9 AM-2 PM. VE Exams at 11:30 AM, (reg. by 11 AM). Exam fee is $5.90; make checks out to *ARRL/VEC*. Bring original and copy of your license, original and copy of any CSCEs held, a calculator and a pen. Talk-in on 147.03/.63 Rptr. Contact *Barbara Holdridge N1ICQ, 107 Church St., Westwood MA 02090; Tel. (617) 329-2628*, or *Gerry Driscoll NV1T, 107 Church St., Westwood MA 02090; Tel. (617) 444-2686.*

AUG 8-10

AUSTIN, MANITOBA, CANADA The Manitoba AR Museum will host a Hamfest on the grounds of The Manitoba Agri. Museum at Austin. Huge Flea Market, Commercial Displays, Rabbit Hunts, and more. For info contact *Dave Syndal VE4XN, 25 Queens Cres., Brandon MB Canada R7B 1G1. Tel. (204) 728-2463.*

AUG 11-13

VERNON, BC, CANADA The 4th annual Sky High Hamfest will be held at Silver Star Mountain Resort. Sponsor: North Okanagan RAC. For details, contact the *North Okanagan RAC, P.O. Box 1706, Vernon B.C. Canada V1T 8C3*. For hotel reservations, call *1-800-663-4431*.

AUG 12

CHANUTE, KS The Chanute Area ARC will sponsor "Hamfest '95" 8 AM-2 PM at the Chanute Nat'l. Guard Armory, 3051 So. Santa Fe. Talk-in on 146.745(-). Contact *Jerry Young, (316) 431-3268, eves.; Charlie Ward, (316) 431-6402;* or *Ted Nantz (316) 537-6001*. For tickets and tables, make checks payable to *C.A.A.R.C.* by July 31st, and send to *Jerry Young KG0EM, 1333 W. Sycamore, Chanute KS 66720.*

DRYDEN, NY The 15th Finger Lakes Hamfest, sponsored by the Tompkins County ARC, will take place at the Dryden H.S., near the intersection of Rt. 13 and Rt. 38. Pre-reg. for VE Exams. Talk-in on 146.97(-). For details, call *Richard Spingarn AA2UP, (607) 387-5251 till 10 PM.*

HUNTINGTON, WV The Tri-State ARA will hold a Hamfest and Computer Show 9 AM-2 PM at the Cabell-Midland H.S., US Rte. 60, at Ona WV. VE Exams Flea Market. Emergency DARREN Packet Net. Talk-in on 146.76(-), 146.64(-), 146.52 simplex, and 444.85(+). Contact *Mike Taylor KB8GCA, (304) 429-1667*. Or write to *T.A.R.A., P.O. Box 4120, Huntington WV 25729.*

HURON, SD The Huron ARC will sponsor their 2nd annual Amateur Electronics Swapfest, 8 AM-3 PM at the Nat'l. Guard Armory, SD State Fairgrounds. Flea Market (setup at 7 AM). VE Exams 9 AM. Talk-in on 146.22/.82. Contact *Lloyd Timperley WB0ULX, P.O. Box 205, Huron SD 57350. Tel. (605) 352-7896 nights.*

RHINELANDER, WI The Rhinelander Rptr. Assn. and Northwoods ARES will hold their "Northwoods Hamfest" at Sugar Camp Town Hall in Sugar Camp., 8 AM-2 PM. Setup Aug. 11th 6 PM-10 PM; Aug. 12th at 6 AM. VE Exams 11 AM; reg. at 10:30 AM. Talk-in on 146.940(-). Contact *Mary Berger NS9Q, 367 Lois St., Rhinelander WI 54501. Tel. (715) 362-9296.*

QUINCY, IL The Western Illinois ARC will hold their Ham Radio and Computer Swapfest 8 AM-2 PM on the Eagles Alps Grounds, 3737 North 5th St. VE Exams at 12:30 PM; call *NA9Q at (217) 224-8526* to pre-reg. Flea Market. Tailgating. XYL Activities. Talk-in on 147.63/.03. Contact *Randy Jackson N9REY, (217) 223-7226.*

AUG 12-13

SILVER CITY, NM The Great New Mexico Chile Chase, sponsored by the Gila ARS, will run 1800 UTC Aug. 12th-1800 UTC Aug. 13th. For details, contact *NM Chile Chase, c/o Gila ARS, P.O. Box 1874, Silver City NM 88062.*

AUG 13

CHARLOTTE, NC The Charlotte ARC Hamfest and Computer Fair will be held 8 AM-4 PM at Roll-A-Round Skate Center, 8830 East Harris Blvd. For info, call *Buck Escott WB4OTP, (704) 522-4971, Ext. 3330*. Talk-in on 147.06(-).

ST. CLOUD, MN The St. Cloud Radio Club will hold its 47th annual Hamfest 8 AM-5 PM at Whitney Senior Center, Northway Dr. VE Exams on a first-come basis. Contact *W0SV, P.O. Box 141, St. Cloud MN 56302;* or packet *W0SV @ NF0H.#CMN. MN.USA.NOAM.*

AUG 17-20

SAN DIEGO, CA The California Computer Expo will run 9 AM-6 PM daily, at San Diego Convention Center, 111 West Harbor Dr. Computer Concerts. Art Contests. Virtual Reality. Weird Software. Much more. Registration deadline is July 31st. Contact *California Computer Expo, 1-800-573-3247* or *(619) 573-0617.*

AUG 18-20

HUNTSVILLE, AL The Huntsville Hamfest will hold the 1st annual Amateur Radio Industry Group Nat'l. Convention at the Von Braun Civic Center and the Hilton Hotel in downtown Huntsville. This is in conjunction with the 1995 Huntsville Hamfest and Alabama State Convention. A "Meet the Manufacturers" hospitality suite will open on Fri. at 5:30 PM at the Hilton Hotel. The Civic Center doors will open at 9 AM on both Sat. and Sun. Ask for special Hamfest rates at the Huntsville Hilton Hotel. Talk-in by K4BFT on 146.94(-) MHz, and 145.38(-) Rptr. For info write *Huntsville Hamfest, P.O. Box 12534, Huntsville AL 35815,* or call *(205) 534-7175.*

AUG 19

BURFORD, ONT, CANADA The Brantford ARC Flea Market will be held 8 AM-1 PM at Burford Fairgrounds. For table reservations contact *Richard La Rose VE3RLX, 153 Dunsdon St., Brandtford Ont., Canada N3R 6N3. Tel. (519) 752-2437;* or write to *B.A.R.C., P.O. Box 25036, Brantford Ont., Canada N3T 6K5.* Talk-in on VE3TCR 147.150(+).

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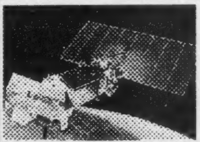

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LONGVIEW, WA The Lower Columbia ARA, W7DG, will sponsor its 4th annual Ham Radio, Computer, and Electronic Equip. Swap Meet, 9 AM-3 PM at the Cowlitz County Fairgrounds in Longview. Setup Fri., 5 PM-9 PM; Sat. 6 AM-8:45 AM. Talk-in on 147.26(+), pl 114.8. Contact *LCARA Swap Meet, P.O. Box 906, Longview WA 98632; or call Bob KB7ADO, (360) 425-6076 eves.* Also, Email to *BobM326571@aol.com* or *75462.3215@compuserve.com.*

AUG 20

CAMBRIDGE, MA A Tailgate Flea Market (Amateur Radio, Electronics, Computer), will be held 9 AM-2 PM at Albany and Main Sts. For space reservations or info, call *(617) 253-3776.* Mail advance reservations before Aug. 5th to *W1GSL, P.O. Box 397082 MIT BR., Cambridge MA 02139-7082.* Talk-in on 146.52 and 449.725/444.725, pl 2A, W1XM/R. Sponsored by the MIT Radio Soc. and the Harvard Wireless Club.

MARYSVILLE, OH The Union County ARC will host the Union County Hamfest and Computer Show 8 AM-2 PM, at Broadway Ohio Community and Civic Complex. Flea Market. ARRL Booth. RC Model Airplanes on display (no flying). VE Exams at Taylor Township Hall (across the street from Hamfest); Reg. 9 AM-9:30. Talk-in on W8BJN 147.39(+) or KE8DQ backup Rptr. 145.35 pl 127.3. Contact *Gene Moore N8YRF, 24461 Claibourne Rd., Marysville OH 43040. Tel. (513) 246-5943.*

AUG 26

ALBUQUERQUE, NM The 1995 Duke City/New Mexico State Hamfest will be held at the New Mexico Army Nat'l. Guard Armory, 600 Wyoming Blvd. NE. ARRL VE Exams, contact *AA5MK, (505) 292-3218.* For Tables (prior to Aug. 21st), call *(505) 821-2771.* Internet queries: *WA5WHN@rt66.com.* Talk-in on KC5FT/KB5SF or 147.15 MHz Rptr. Send checks to *Duke City Hamfest, P.O. Box 6552, Albuquerque NM 87197-6552.*

ATHOL, MA The Mohawk ARC 3rd annual Amateur Radio, Computer Flea Market will be held rain or shine at Mohawk Drive-in Theater, Gardner MA. General admission at 8 AM; Setup at 6 AM. For advanced reg., send your name, address and phone number to *M.A.R.C., P.O. Box 532, Athol MA 01331.* Enclose $5 for each space you want to reserve. For more info, contact *John WF1L, (508) 249-5905, 4 PM-9 PM; Paul N1IPG, (508) 632-9432, 6 PM-10 PM; Tom N1KKY, (508) 249-4521, 5 PM-9 PM.*

BRIDGEWATER, NJ The Somerset County ARS, Inc. annual Hamfest will be held at the Somerset County 4H Center on Milltown Rd., just off of Route 202. Time: 8 AM-1 PM. Setup at 6 AM. Talk-in on 448.175(-). Call *Eric NW2P, (908) 753-8290.* Write *SCARS, P.O. Box 742, Manville NJ 08835.*

CHAFFEE, NY The Pioneer Radio Operators Soc. 4th annual Ham and Computer Fest will be held 7 AM-3 PM in Manion Park, located just off NY Route 16. Talk-in on 145.39. For a map and tickets, SASE to *Mike Wrona, 139 Greenmeadow Dr., West Seneca NY 14224.*

LIVERPOOL, NY The Radio Amateurs of Greater Syracuse will host their 40th Hamfest at the Academy Green American Legion in Syracuse NY. Flea Market setup 7 AM. Open to the public 8 AM. Commercial vendors 9 AM. VE Exams; leave message at *(315) 469-0590;* or write *RAGS, P.O. Box 88, Liverpool NY 13088.*

AUG 26-27

WOODLAND PARK, CO The Mountain ARC will hold its 14th annual MARC Campfest-Swapfest at Quaker Ridge Camp, 6.5 miles north of Woodland Park city center, on Hwy. 67 North (M.P. 82.5). Advance reg. essential; write to *MARC, P.O. Box 1012, Woodland Park CO 80866-1012,* promptly. Send an SASE for info sheet. Or, call *Don Chamberlain AA0NW, (719) 687-3692; Fred N0PKA or Patty N0PSD, (719) 687-9727.*

AUG 27

CORUNNA, MI A Five County Amateur Radio/Computer Swap 'N' Shop will begin at 8 AM at Shiawassee County Fairgrounds, 2900 E. Hibbard Rd. Setup at 6 AM. Flea Market. Trunk Sales. Talk-in on 147.020(+), or 146.520 simplex. For info, contact *Jan, (517) 893-3475.* Sponsors: Bay Area ARC; Genesee County RC; Lapeer ARA; Mid-Michigan Wireless Assn.; and Shiawassee ARA.

FOWLERVILLE, MI The Livingston ARK will host the Livingston County HamFair at Fowlerville Fairgrounds, Grand River Rd. (M43). VE Exams. Ham/Computer/Electronic Equip., new and used. Covered Trunk Sales. Flea Market. Time: 8 AM-3 PM. Setup at 6 AM. Talk-in on 146.680(-). When writing, send SASE. Contact *LARK, P.O. Box 283, Howell MI 48843;* or call *John, (517) 548-1412.*

LEBANON, TN A Special Event will be sponsored by the Short Mountain Rptr. Club, 7 AM-3 PM at Cedars of Lebanon State Park, US Hwy. 231, 7 mi. South of I-40. Outdoors only. Bring your own tables (spaces first-come, first-served). For details, contact *Thomas Page AD4AI, P.O. Box 2741, Lebanon TN 37088-2741. Tel. (615) 449-5610.*

SEP 1-3

COSTA MESA, CA The ARRL Southwestern Div. Convention (HAMCON '95) will be held aboard the Queen Mary, Long Beach CA. Contact *Chairman Nate Brightman K6OSC, (310) 427-5123.*

SEP 2

INDIANAPOLIS, IN The Hoosier Hamfest and Computer Show will be held 8 AM-3 PM at the Indianapolis Nat'l Guard Armory, Holt Rd. and Minnesota, off I-70. Sponsor: Electronic Applications Radio Service (EARS, Inc.). Largest Vendor Display in the area. Setup 6 AM-8 AM. Talk-in on 145.250 Indianapolis. *Contact Marty Hensley KA9PCT, 7205 Mohawk Ln., Indianapolis IN 46260. Tel. (317) 253-7985 eves.*

SPECIAL EVENT STATIONS

AUG 5

DULUTH, MN Doug KB9IES and Les WA0QIT will operate SE Station WA0QIT 1600Z-2100Z from Bayfront Park, as part of the 48th annual Duluth Internat'l. Folk Festival. Freq. will be 14.255 MHz. Send QSL with 9" x 12" SASE, or #10 envelope for a folded certificate, to *ARS - WA0QIT, 123 S. 65 Ave. W., Duluth MN 55807.*

AUG 6-12

POTTSVILLE, PA The Schuylkill ARA will operate an SE Station to celebrate the week of the Schuylkill County Fair. The Station will use the individual operator callsign with a suffix of "Schuylkill County Fair," or "/SCF" if operating CW. Operation will be both phone and CW in the Novice and the General subbands. For a certificate, please send an SASE to *Ed Brennan N3ILC, 520 Spring Garden St., Pottsville PA 17901.*

AUG 12-13

HAGERSTOWN, MD The Antietam RA will present the 1995 Maryland-DC QSO Party, 1600Z Aug. 12th-0400Z Aug. 13th, and 1600Z-2359Z Aug. 13th. Contact *Antietam Radio Assn., P.O. Box 52, Hagerstown MD 21741-0052.* Send logs with SASE by Sep. 10th.

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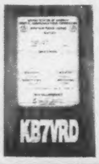

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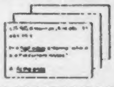

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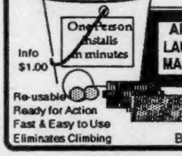
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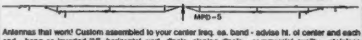

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SOMERSET, PA The Somerset County ARC will operate NJ3L from the highest point in PA at Mt. Davis. Operations will be 1700Z Aug 12th-2000Z Aug. 13th. Listen on the lower 50 kHz of the General class phone bands of 10-80 meters, as conditions allow. For a certificate, send QSL and SASE to *NJ3L, Dudley Daniels, RD 7 Box 270, Somerset PA 15551.*

AUG 18-SEP 4

TORONTO, ONT., CANADA The VE3CNE Committee will operate Station VE3CNE in conjunction with the Canadian Nat'l. Exhibition. All Amateurs visiting Toronto are invited to come to Exhibition Place and operate the station. The station will be located at the Internat'l. Pavilion, just inside the Princes' Gates at the east end of Exhibition Park. Operation will be daily from 10 AM-10 PM local time. During the day the local 80 and 40 meter phone nets will tell you where to find VE3CNE. CW: 80m 3.645-3.700, 40m 7.045-7.145, 20m 14.035-14.055, 15m 21.045-21.145. SSB: 80m 3.745-3.865, 40m 7.065-7.235, 20m 14.145-14.245, 15m 21.300-21.400. VE3CNE will also be found on packet, VE3CNE @ VA3BBS, and on the local rptrs. QSL cards will be sent to all contacts via the QSL Bureau.

AUG 19

FRANKFORT, NY The Fort Herkimer ARC will operate AA2AT, 1400Z-2200Z to commemorate the annual Herkimer County Fair. Operation will be in the General portion of 20m phone, and on 40m, the Novice CW portion and General CW and phone portions, and 2m packet. For a certificate, send QSL/SWL and a 9" x 12" SASE to *AA2AT Madeline Loiacano, 96 Grove St., Ilion NY 13357.*

AUG 19-20

BATAVIA, NY The Genesee Radio Amateurs will operate W2RCX 1300 UTC-2100 UTC Aug. 19th and Aug. 20th, to celebrate the 15th annual "1941 Wings of Eagles Airshow" being held at Genesee County Airport. Operation will be on 40m, 7.250 +/- 20, and on 20m 14.250 +/- 20. For a certificate, send QSL and a 9" x 12" SASE to *GRAM, P.O. Box 572, Batavia NY 14020.*

ENGLEWOOD, NJ The Englewood ARA, Inc. invites all amateurs the world over to take part in the 36th Annual New Jersey QSO Party, 2000 UTC Sat., Aug. 19th-0700 UTC Sun., Aug. 20th; and 1300 UTC Sun., Aug. 20th-0200 UTC Mon., Aug. 21st. Phone and CW are considered the same contest. Logs and comments should be sent to *Englewood ARA, Inc., P.O. Box 528, Englewood NJ 07631-0528.* Please include a #10 SASE for results. NJ stations are requested to advise EARA by Aug. 1st so that full coverage from all counties can be planned.

VANCOUVER, WA The Clark County ARC will operate Club Station W7AIA at the annual Northwest Antique Aircraft Fly-in at Evergreen Flying Field (just east of Vancouver WA). Tune in the lower portion of the General class band on the 80, 40, 20, 15, HF bands, and 2m, 146.52 for local contacts. The local 147.84/.24 Rptr. may also be monitored. For a certificate/QSL, send a #10 SASE to *CCARC, P.O. Box 1424, Vancouver WA 98668.*

AUG 20

FISHERS ISLAND SOUND, NY For only the ninth time in history, amateur radio is going to Flat Hammock Island. Tri-City ARC will mount this year's expedition and will operate KA1BB 1300Z-2000Z. Operation will be in the lower 20 kHz of the General class phone and CW bands, 20 and 40 meters. QSL w/letter size SASE via *Tri-City ARC, Box 686, Groton CT 06340.*

AUG 21

COLUMBIA, PA The Columbia Area ARC will operate from 1400Z-2100Z to commemorate the 100th Anniversary of the Bainbridge Band. Freq.: 7250 kHz, 7125 kHz, 14250 kHz, 14044 kHz, and 146.715(-) MHz. For a certificate, send QSL and 8 1/2" x 11" SASE to *Columbia Area ARC, P.O. Box 574, Columbia PA 17512.*

AUG 24-SEP 4

LIVERPOOL, NY The Liverpool ARC will operate K2YGF Aug. 25th-Sep. 4th from the New York State Fair. SSB and CW operation in the lower 25 kHz of the 80, 40, and 20m General sub-bands. Other bands and modes as conditions permit. For a certificate, send QSL and 9" x 12" SASE to *Liverpool ARC, P.O. Box 103, North Syracuse, NY 13212.*

AUG 25

WASHINGTON, DC Fleet Radio Pacific (FruPac), the Amateur Radio Operators of the Naval Cryptologic Veterans Assn. will operate N3GKE 1400Z-2000Z, from 3801 Nebraska Ave. This commemorates the move of Naval Security Group Headquarters to Maryland from Washington. Freq.: 7.234, 14.243 and 21.375 MHz +/- QRM. A 9" x 12" certificate will be issued to all who make contact and send QSL and SASE to *NU3D, 7801 Overhill Rd., Glen Burnie MD 21060.*

BANGOR, PA The Delaware Lehigh ARC will operate W3OK 1200Z-2400Z in conjunction with the 50th annual running of the Blue Valley Farm Show. Operation will be 40 kHz into the General phone portions of 80, 40, and 20 meters, and 28.400 MHz. CW contacts on request. 2m FM contacts on 146.580. A packet PBBS is planned for 145.090. Confirmed contacts can receive a QSL certificate by sending a 9" x 12" SASE to *DLARC QSL Manager, BVFS Special Event, RR #4 Greystone Bldg., Nazareth PA 18064.* Please send sufficient postage.

SEP 2

CONCORDIA, KS The Kansas-Nebraska ARC will operate W0OYA to commemorate the 50th Anniversary of the end of the War against Japan. The Station will operate from the home stations of W0TQ and W0NBT, which are near the World War II German POW camp. Phone: lower 25 kHz of the General phone portions of 40, 20, 15, and 10 meter bands, 1600Z-2300Z; and 80 and 75 meter bands from 2300Z-0300Z. For a QSL certificate, send QSL and large SASE to *Kansas-Nebraska ARC, c/o Arlan Campbell W0NBT, Rt. 3 Box 20-A, Concordia KS 66901.*

SEP 2-4

CASPER, WY The Casper ARC will operate Station W7VNJ 1800 UTC-2400 UTC each day, to commemorate the 100th Anniversary of the first oil refinery in Wyoming (at Casper). SSB operation will be in the bottom 50 kHz of the General portion of the 75, 40, 20 and 15 meter bands, and in the Novice portion of the 10 meter band, conditions permitting. For an 8" x 11" certificate, please send QSL card and 9" x 12" (for flat), or business size (for folded) SASE to *CARC, Special Event, P.O. Box 2802, Casper WY 82601.*

WATERFORD, CT The Tri-City ARC will operate KA1BB from the Waterford CT I-95 weigh station, to promote safe Labor Day holiday auto travel. This event is in conjunction with the 6th annual Stay-awake Coffee Stop sponsored by the BSA Troops from Niantic CT. Operation will be 1700Z Sep. 2nd-1800Z Sep. 4th, in the lower 20 KHz of the 80, 40, 20, and 15 meter General class phone and CW bands. Talk-in to Coffee Stop on FM 146.52 direct, and CB Channel 19. QSL with letter size SASE, via *Tri-City ARC, P.O. Box 686, Groton CT 06340.*

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Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old-timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to the Barter 'n' Buy, *73 Magazine*, 70 Rt. 202N, Peterborough NH 03458, and get set for the phone calls.

The deadline for the October 1995 classified ad section is August 10, 1995.

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PROPAGATION

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Conditions This Month

Radio propagation this month is likely to make DXers, who have only weekends to hunt for rare ones, very unhappy. The really Poor days of the month of August are likely to be 4–7, 14, and 19–22. The Best days are possible on 1, 9–11, 25–27, and 31. The remaining days are trending one way or another through Fair. It is also possible that there may be some severe weather and other geophysical upsets on 5-6, 14, and 20-21. Listen carefully to WWV at 18 minutes after any hour for the latest updates on "conditions" and special alerts. It would be worthwhile also to monitor weather channels on the dates mentioned above.

10, 12, and 15 Meter Bands

Sporadic-E propagation on many (G) or (F) days, with good signal strengths of short duration and quick fading. The ionized clouds drift with the high-altitude winds. Expect skip to 1,500 miles or so, and beam across the equator for possible contacts in the opposite hemisphere. These bands will close at sunset.

17 and 20 Meter Bands

Twenty will be best, and sometimes 17 will be almost as good, but not as heavily occupied. If open, the higher-frequency band will provide the longest skip. Twenty will remain open after sunset and sometimes late into the evening. Seventeen will close at dark or shortly after. Possible grey-line DX along the terminator is a bonus.

30 and 40 Meter Bands

Excellent nighttime possibilities on evenings when QRN is low and "conditions" are Good. Thunderstorms between you and your target can make copy difficult, if not impossible. Daytime short skip out to 1,000 miles is frequent, and nighttime skip to 2,000 miles or more will occur less regularly. Thirty meters will behave more like 20, and 40 meters will behave more like 80 on many occasions, due to the height of the reflecting layer at that time. Always check the next-higher and next-lower bands.

80 and 160 Meter Bands

Expect lots of QRN. You'll hear very few signals on 80 during the day, and none on 160. These bands are the nighttime bands in summer, and it pays for you to keep a sharp ear open after sundown. On particularly good nights with low noise, you will find both long skip and DX on both bands. Avid DXers must be patient, however, because in summer there's almost always noise present. I'd recommend that you use the long summer days and evenings for building up better antennas for these bands, and wait until fall for conditions to improve.

JUNE 1995						
SUN	MON	TUE	WED	THU	FRI	SAT
		1 G-F	2 F	3 F-P	4 P	5 P
6 P	7 P-F	8 F-G	9 G	10 G	11 G-F	12 F
13 F-P	14 P	15 P-F	16 F	17 F-G	18 G-F	19 F-P
20 P	21 P	22 P-F	23 F	24 F-G	25 G	26 G
27 G	28 G-F	29 F	30 F-G	31 G		

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA						20	20					
ARGENTINA	20	20	20	40			20	20	15	15	15	15
AUSTRALIA		20	20	20	40	40	20					
CANAL ZONE	15	40	40	40	40[1]	40		15	15	15	10	10
ENGLAND			40[1]	40			20	20	20	20	20	20
HAWAII			20		40		20					
INDIA												
JAPAN						20	20					
MEXICO	15	40	40	40	40[1]	40		15	15	15	10	10
PHILIPPINES							20					
PUERTO RICO	15	40	40	40	40[1]	40		15	15	15	10	10
SOUTH AFRICA			40	40		20	20				20	
U.S.S.R.							20	20		20		
WEST COAST	20	40	40	40[1]	40[1]	40						20

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA		20	20					20	20			
ARGENTINA	15	20	20	40			20	20		15	15	15
AUSTRALIA	15	20	20	20	40[1]	40		20			20	
CANAL ZONE	15	20	20	20	40[1]	40	20	20	15	15	15*	10
ENGLAND	20	40					20	20		20	20	20*
HAWAII	15	15	20	20	20	40	20	20				
INDIA												
JAPAN		20	20					20	20			
MEXICO	15	20	20	20	40[1]	40	20	20	15	15	15*	10
PHILIPPINES		20	20				20	20				
PUERTO RICO	15	20	20	20	40[1]	40	20	20	15	15	15*	10
SOUTH AFRICA							20				20	20
U.S.S.R.								20			20	

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA		20	20						20			
ARGENTINA	15	20	20	40	40			20	20		15	15
AUSTRALIA		20	20	20	20	40[1]	40[1]		20		15	15
CANAL ZONE	15	15	20	20[1]	40[1]	40		20	20	15	15	15
ENGLAND	20							20	20			20
HAWAII	20	15	15	20	20	20[1]	40[1]	40	20		20	20
INDIA				20					20			
JAPAN		20	20						20			
MEXICO	15	15	20	20[1]	40[1]	40		20	20	15	15	15
PHILIPPINES				20					20			
PUERTO RICO	15	15	20	20[1]	40[1]	40		20	20	15	15	15
SOUTH AFRICA			40						20			
U.S.S.R.									20			
EAST COAST	20	40	40	40[1]	40[1]	40						20

[1] Check next higher band

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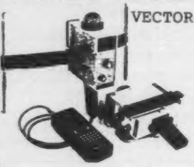

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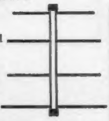

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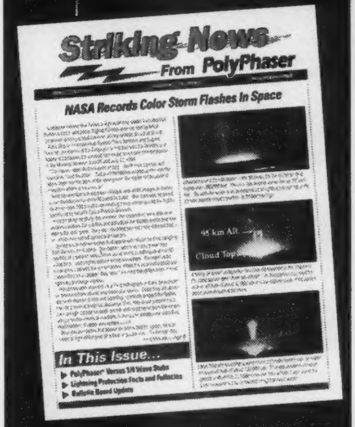

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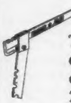

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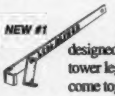

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Until wiser herds . . . er, heads . . . are able to dump the code requirement from the ham exams, the El Zippo and Courageous are the least frustrating route to ham nirvana. And by the way, anyone can learn the code if they go about it Uncle Wayne's way.

SOFTWARE

GGTE Morse Tutor From beginner to Extra Class. Code from 1 to over 100 words per minute. Standard or Farnsworth mode. Create your own drills. Exams conform to FCC requirements. 5 1/4" floppy for IBM PC, XT, AT, PS/2 or compatibles.

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73T20 **"Courageous" $5.95 20+ wpm** Congratulations! Okay, the challenge of code is what's gotten you this far, so don't quit now. Go for the extra class license. We send the code faster than 20 per.

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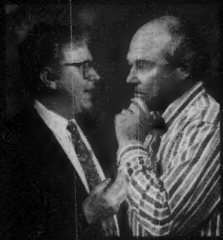

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  LSB/USB (J3E Voice),
  CW (A1A)
  FM (F2D, FSK, F3E Voice)
  TV (A3F optional, for 1.2 GHz*)
  ***Requires optional Unit**

YAESU

Choice of the World's top DX'ers

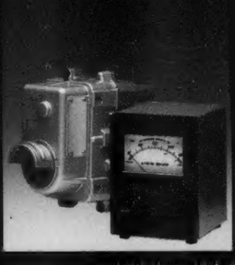
G-500A

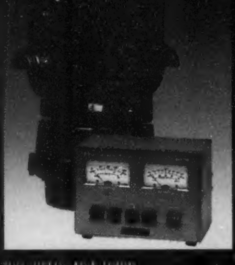
Elevation rotator for space communication antennas.

Max. Antenna Wind Load: 12 sq. ft.

Mast Size: 1[illegible]–2[illegible]

Boom Dia.: 1[illegible]–1[illegible]





G-5400B

Azimuth-Elevation combination for space communication antennas. DIN connection for computer operation.
Max. Antenna Wind Load: 11 sq. ft.
Mast Size: 1[illegible]–2[illegible]
Boom Dia.: 1[illegible]–1[illegible]
Rotator Size: 12[illegible]" H x 7[illegible]" Dia.
(Mounted together)
(GS-232 Computer Interface Available)

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Specifications subject to change without notice. Specifications guaranteed only within amateur bands. Check with your local Yaesu dealer for specific details.

Kenwood's TS-50S :
Awesome HF Versatility

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HF TRANSCEIVER TS-50
POWER
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AF SQL
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SCAN
CLR
M.IN
M>V
M/V
A/B
SPLIT
A=B

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With purchase of TS-50S
(See dealer for details)

TS-50S
HF TRANSCEIVER

For the Amateur Radio enthusiast, going "beyond bounds" is what it's all about. That's why Kenwood created the TS-50S, the world's smallest and smartest HF transceiver. The choice is yours: you can mount it in a vehicle, take it on a DX-pedition, or even install it permanently as a base station transceiver. Yet despite its size, the TS-50S provides a maximum output of 100W and the sort of sophisticated features normally found only inside a shack. Take for example the 100 memory channels for independent storage of transmit/receive parameters, the microprocessor-controlled DDS with innovative "fuzzy" control, and Kenwood's own AIP for superior dynamic range. There's also a powerful menu system, IF shift and CW reverse mode for interference reduction, TF-SET, and a noise blanker--plus everything you need for split-frequency operations. So, if you want HF operation beyond bounds, check out the TS-50S at your favorite authorized Kenwood Amateur Radio Dealer today!

Features
- 500kHz-30MHz general coverage receiver
- DDS(Direct Digital Synthesizer) with fuzzy logic control
- Large LCD panel with digital bar meter
- Auto-mode capability
- Menu system
- AIP (Advanced Intercept Point)
- Switchable AGC Circuit (SLOW/FAST)
- All-mode squelch
- CW reverse mode
- Full break-in and semi break-in
- 20dB attenuator
- Multi-function microphone supplied
- RF output power control (100W, 50W, 10W)
- Optional 500Hz CW filter (YK-107C)
- Optional external antenna tuner(AT-50)
- Optional computer interface (IF-10D)

95ARD-1209

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KENWOOD ELECTRONICS CANADA INC.
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